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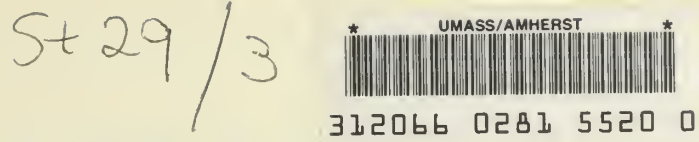

STAYING ALIVE

Preventing Child Death
The Massachusetts Child Death Study

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THE COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC HEALTH

MICHAEL S. DUKAKIS, GOVERNOR
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DEBORAH PROTHROW-STITH, COMMISSIONER OF PUBLIC HEALTH

STAYING ALIVE...

PREVENTING CHILD DEATH

THE MASSACHUSETTS CHILD DEATH STUDY

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH
BUREAU OF PARENT, CHILD AND ADOLESCENT HEALTH
150 TREMONT STREET
BOSTON, MA 02111

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ON VIOLENCE AGAINST CHILDREN

This report reflects the assistance of a wide variety of professionals, including public agencies, state and local police, the Fire Marshal, and district attorneys.

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EXECUTIVE SUMMARY

The Massachusetts Child Death Study has been prepared by the Massachusetts Department of Public Health at the request of the Legislature's Special Commission on Violence Against Children. Through the presentation of detailed information on the 1,332 children ages birth through 19 who died in 1985, the Study serves as a basis for assisting professionals and decision makers in program and policy planning to prevent unnecessary deaths.

To provide rich detail on the lives and deaths of these children, researchers went beyond the death certificate, exploring multiple sources including newspaper clippings, and documents from the medical examiners, state and local police, the Registry of Motor Vehicles, fire departments and district attorneys. In addition, the Study reviewed hospital records and information collected by state agencies serving children and adolescents.

In addition to the 1985 in-depth study, child mortality statistics for 1980-84 were analyzed to provide an overview of child deaths in Massachusetts during the five-year period preceding the Study. The report contains detailed information on many facets of child death. Briefly, the data reveal the following facts.

First, during 1980-1984, death rates of Massachusetts children were lower than the national average for all age groups and for both medical-related and injury deaths.

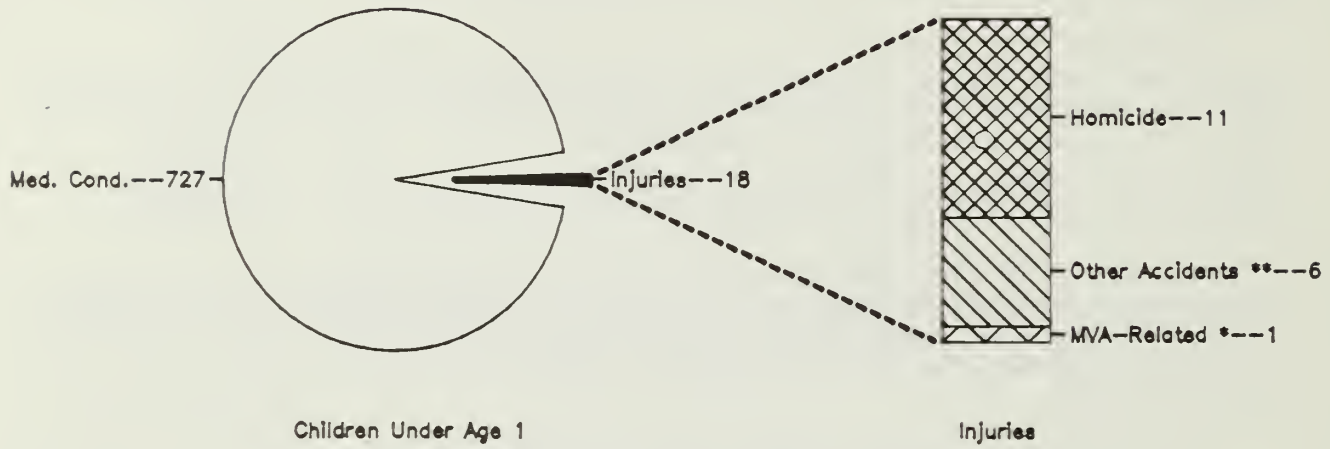
After age 1, injuries are the leading cause of death to Massachusetts children (see graph next page). Motor vehicle-related accidents are by far the major cause of death, followed by suicide and homicide. Drownings, fires, suffocation and poisoning were also important causes of child mortality. The circumstances of injury differ materially by age. Younger children were injured most frequently in or around the home, while adolescent injuries occurred away from formal settings and were often associated with illegal or risk taking behavior. Additionally, through the Study, a number of other factors were identified which are useful in targeting preventive measures for groups which are at higher risk of injury, (e.g. socioeconomic status, race, and age).

Approximately half of all childhood deaths, ages 1 month through 19 years, are caused by medical conditions, primarily congenital anomalies and Sudden Infant Death Syndrome (SIDS). Almost nine out of ten children dying from medical conditions suffered from significant chronic illness prior to their terminal hospitalization. For children less than one month (the neonatal period), almost all deaths were disease-related; two thirds of these were related to perinatal conditions.

The second major finding of the Study is that human service agencies serving children are reaching an important segment of the child population that is at high risk. For example, among children 9-19 years who died in 1985, 21% had had contact with at least one of three state agencies (Department of Social Services, Department of Youth Services, or Department of Mental Health), at some point in their lives.

1985 CHILD DEATHS BY AGE AND CAUSE

As Coded by the Child Mortality Study

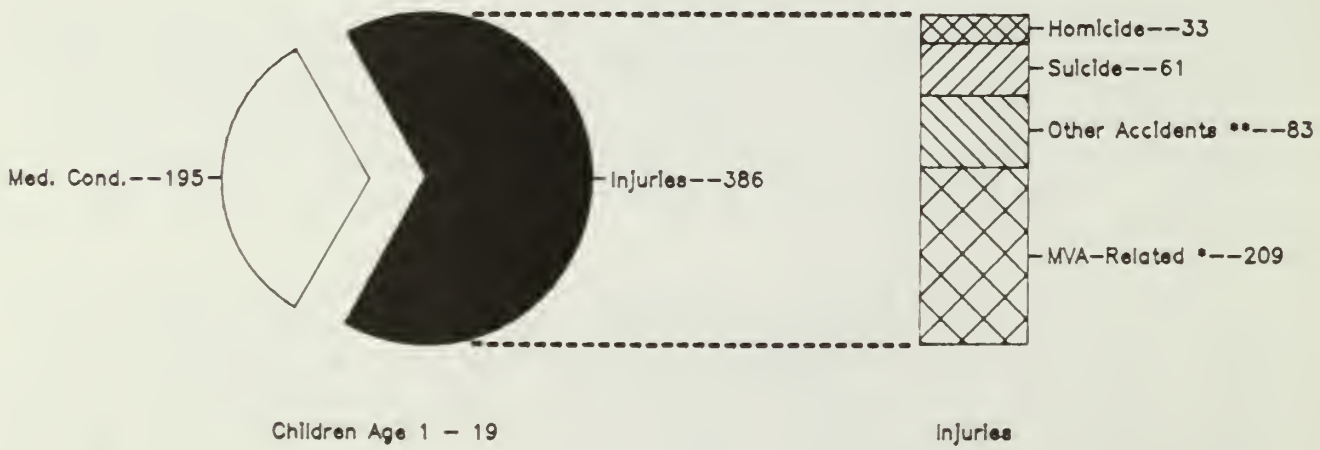


* Motor vehicle-related deaths include motor vehicle collisions with pedestrians and bicycles.

** Other accidents includes drowning, fires suffocation, poisoning, falls, and other accidents.

1985 CHILD DEATHS BY AGE AND CAUSE

As Coded by the Child Mortality Study



* Motor vehicle-related deaths include motor vehicle collisions with pedestrians and bicycles.

** Other accidents includes drowning, fires suffocation, poisoning, falls, and other accidents.

Finally, gaps exist in the current data system. The Study revealed that existing data collection systems underreport injuries in general, and violent deaths in particular. Investigators searched out and examined multiple sources of data to get a complete picture of each case.

The results of this Study lead to the recommendation that to improve child health status in Massachusetts, a Childhood Injury Prevention Initiative be implemented through a designated state agency.

Most injuries can be predicted and prevented. The field of injury control has advanced to the understanding that a predictable sequence of events between a person, environment and source of energy leads to an injury. Using a public health approach of education, legislation/regulations, and use of technology, proven strategies can be applied to prevent both unintentional and intentional injuries. Guided by the data from the Study, these strategies can be effectively targeted to the most at-risk populations for the most prevalent types of injuries.

The Department of Public Health has supported innovative injury prevention activities since 1979, and should be designated the lead agency for a statewide initiative. The four major components of this initiative should include:

- Adolescents. Three-quarters of the deaths among 15-19 year olds were due to injuries; most involved males, and frequently involved risk-taking behavior.
- Violence. Study findings document the serious toll of violence among children and adolescents. Working collaboratively with public safety and criminal justice officials, public health providers can use multidisciplinary strategies to affect primary prevention, secondary prevention and more intensive interventions.
- Motor vehicle-related injuries. In the Study, over half of all injury deaths among children and adolescents were motor vehicle-related. The many injury prevention strategies available to reduce these injuries need to be evaluated and considered for future action.
- Injury surveillance. The capacity to monitor trends and patterns in child mortality and morbidity over time will also allow staff to maximize targeted services and assess program effects.

Additionally, since the Study confirmed that human service agencies serve children who are at high risk, training should be provided to relevant state agency staff for the purpose of maximizing their opportunities to prevent injuries.

CHAPTER I. INTRODUCTION

Improving the health status of children through prevention of disease, disability and death has been an ongoing objective of public policy at the national, state, and local levels. Childhood death, the topic of this report, is only one measure of the health status of children. Although the number of deaths does not always reflect the relative prevalence of non-fatal diseases or injuries, the study of these most extreme and tragic outcomes can hopefully offer clues for the development of strategies to improve the health status of the Commonwealth's children.

STUDY BACKGROUND

The idea for the Child Death Study came from the Special Commission on Violence Against Children, a joint legislative commission established under Section 23 of Chapter 204 of the Acts of 1983 with the purpose of: "making an investigation and study relative to the causes of violence against children and ways to reduce the incidence thereof." The Commission consists of members of the Senate and House of Representatives, the Secretary of Human Services, the Commissioner of the Department of Social Services, the Director of the Office for Children, and eleven persons appointed by the Governor. The appointed members represent a broad spectrum of organizations and agencies concerned with the well-being of children such as the courts, police, medical, social service, and child advocacy groups. In its preliminary work plan for 1985-1986 the Commission described itself as: "a diverse, multibranch forum for policy review and development, for technical assistance and for legislative recommendations." Although the Commission was established in conjunction with the Child Abuse Reporting Bill (Chapter 288), it has viewed its mandate for reducing the incidence of violence against children in broad terms. The Commission's overall goal of developing a sound and integrated response to the safety and welfare needs of the Commonwealth's children, coupled with its emphasis on preventive efforts, led to the Child Death Study.

STUDY OBJECTIVES

This Study aims to educate people who are concerned with the welfare of children about one criterion for measuring the health status of children in the community. By providing a picture, a perspective of childhood deaths in the Commonwealth in an historical and national context, the Study intends to raise public consciousness about the progress that has been made in improving child health, about public programs that have contributed to this progress and about the goals that need to be tackled in the future. The Study was also designed to collect and present detailed information that can contribute to the understanding of professionals and policymakers charged with program planning and development.

The specific objectives are:

- to describe trends and patterns of child deaths in Massachusetts and compare them with national child mortality statistics;
- to investigate the prevalence of a number of risks and potential risk factors in a population of deceased children in Massachusetts;
- to determine service-system responses to children and families who were considered to be at high risk;
- to characterize high risk groups in terms that are compatible with public policy development; and,
- to identify patterns of preventable child death and to recommend strategies aimed at reducing childhood fatalities.

WHY A SPECIAL STUDY WAS NEEDED

The Child Death Study was designed to collect information from several agencies and organizations in addition to data available to the Department of Public Health.

The goals and objectives of this Study could not have been met using only conventional data sources. The major source of information for population based studies of mortality is vital statistics compiled from death certificates. By providing systematic information about the demographic characteristics of the deceased population (i.e. age, sex, race, place of residence) and about the cause and manner of death, vital statistics permit comparisons of mortality patterns over time, between geographic locations and among population groups.

At the same time, the scope of data available from death certificates is limited. Thus, important information on the events that preceded the death, on circumstances that led to injury, as well as on social background and access to sources of care, requires data collection from additional sources.

The following examples demonstrate how a detailed analysis of information from a variety of sources can lead to the design of effective preventive measures. The New York City Department of Health developed a health education program to combat the high incidence of child deaths and injuries due to falls from windows. The program was initiated after the City's Bureau of Health Statistics called attention to the frequent number of deaths due to falls from high places among young children. Analysis of existing vital statistics data, together with field visiting to homes and cooperation with medical and community groups made it possible to identify the areas of highest risk and develop a direct preventive intervention. The success of the program, named "Children Can't Fly," in drastically reducing death and injury, persuaded the New York City Board of Health to amend the Health Code to require that landlords provide window guards in apartments where children ten years old and younger reside.[1]

In another case, observations of medical examiners about child deaths resulting from the design of baby cribs were followed by an in-depth investigation carried out by the U.S. Consumer Product Safety Commission. The Commission conducted a hazard analysis of injuries related to cribs based on

hospital surveillance information, interviews with family or witnesses, and review of death certificates. As a result of its investigation, the Commission identified some problem areas in the design of cribs that supported the necessity of introducing the 1974 Crib Standards Regulations.(2) Today, for example, the distance between crib components such as slats or spindles cannot be greater than two and three-eights inches. This spacing prevents a child's body, which is smaller than the head, from slipping through and becoming suspended between the bars, a situation commonly described by coroners as a cause of death before the crib requirements were introduced.

STUDY METHOD

The study plan included a two tier approach. First, an overview of child deaths in Massachusetts during the five year period of calendar years 1980-1984 was undertaken. The analysis is based on computerized death files available from the Department of Public Health's Registry of Vital Records and Statistics. Chapter II provides a descriptive profile of the population studied, presents mortality rates by cause of death, and compares Massachusetts child mortality rates with national statistics.

Second, an in-depth study of all child deaths in 1985 was conducted. The Study reviewed individual records of children from birth through age 19 who died during calendar year 1985 and who were residents of Massachusetts at the time of death (including residents who died out of state). A surveillance system was set up to identify 1985 child deaths as soon as possible after they occurred. The system relied on newspaper reports obtained through a statewide newspaper clipping service, on death certificates received by the Registry of Vital Records, and on lists obtained from the Office of the Chief Medical Examiner.

The Study then developed special agreements permitting access to information available to other officials and agencies charged with investigating deaths and the circumstances surrounding death. These officials include medical examiners, state and local police, the Registry of Motor Vehicles, fire departments, and district attorneys. Additional knowledge about the medical, social and welfare status of deceased children was obtained through agreements with hospitals and with major state agencies serving children and adolescents (the Massachusetts State Departments of Social Services, Youth Services, Mental Health and Public Welfare). Records were placed in locked file cabinets with access limited to Study staff who signed agreements of non-disclosure of individual information.

Data collection from multiple sources has resulted in rich detail. At the same time, records reviewed and abstracted by the Study varied greatly in their content and extensiveness. One reason for the variation arises from the special mission of different agencies in investigating a death. Differences in personal style and local practice also influence the type of information gathered and recorded by various officials. As a result, some records contain

extensive narratives that tell a great deal about the child's life and about the circumstances that led to death, while other records offer only limited information. Nevertheless, coding instruments were developed to generate a uniform data set amenable to statistical analysis.

The Study population was divided into two groups for the purpose of data analysis:

1. Deaths from medical conditions: includes infants who died within 28 days of birth from natural causes such as perinatal conditions, congenital anomalies, and other medical conditions. For this group, only basic demographic information was collected and coded in order to avoid duplication of effort with other units at the Department of Public Health which have been analyzing neonatal and infant mortality data in depth. The medical conditions group also includes children aged 4 weeks through 19 years who died as a result of diseases and medically-related conditions. A special form was designed to code medical information, which was gathered primarily from hospital medical records.

2. Deaths from injuries: includes children from birth to age 19 who died as a result of intentional (homicide and suicide) or unintentional injury. Coding instruments were developed to capture circumstances common to all injuries such as time of day, location, child's activity, presence of alcohol or drugs, etc. Social risk factors as well as information pertaining to the specific cause of injury (i.e. fire, drowning, suicide) were also coded. Coding of injuries was complex because it was based on a large number of information sources.

CONFIDENTIALITY

Strict confidentiality procedures were established to secure individual records, protect the privacy of families, and ensure anonymity in the presentation of findings. Quotes from records and case vignettes are used in Chapter IV in order to provide some insight into the complexity of situations associated with deaths from injuries. In every case where such material was used, several details were changed in order to prevent identification of individuals.

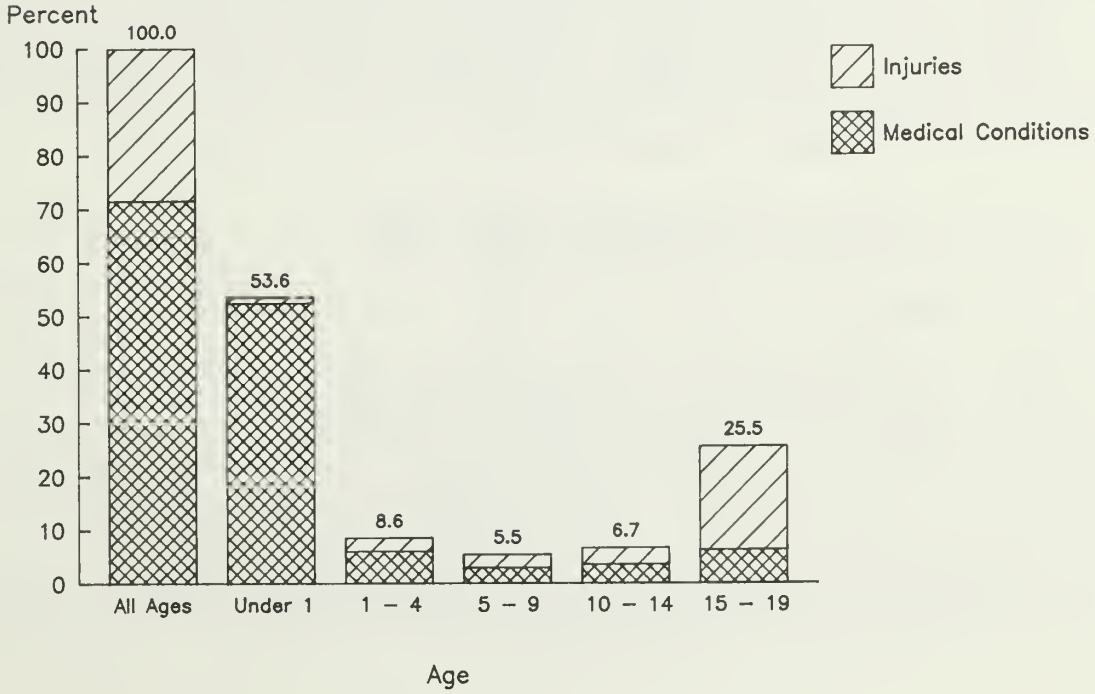
Findings of the 1985 Child Death Study are presented in Chapters III through VI of this report. It should be borne in mind that statistics presented in this report are not always identical with official vital statistics data on child deaths for 1985. Unless otherwise noted, the findings reflect data specifically collected and coded for this Study. Comparisons between Study findings and vital statistics are presented selectively to illustrate points of interest.

CHAPTER II. CHILD DEATHS IN MASSACHUSETTS: AN OVERVIEW

BACKGROUND

During the five-year period of 1980-1984, there were 6717 deaths of Massachusetts resident children, an annual average of 1343 deaths among approximately 1.6 million child residents 0-19 years of age. Two age groups, infants and adolescents, accounted for almost 80% of child deaths, although the causes of death were vastly different for each group. Whereas medical conditions accounted for 98% of deaths to infants under one year of age, injury-related deaths accounted for 75% of all deaths of adolescents 15-19 years of age (Chart A). Fewer deaths occurred after infancy and before the teenage years, but the percentage of injury-related deaths increases consistently with age. After age one, injuries are the leading causes of childhood death. In Massachusetts, six out of ten children over age one who died, died as a result of an injury during the five-year period between 1980 and 1984.

Chart A.
Percent Distribution of Child Deaths by Age
and Cause of Death
Massachusetts 1980 – 1984



The emergence of injuries as a priority concern is due in part to the great progress made in this century in improving the health status of children. Mortality rates in the first year of life have declined markedly since the turn of the century. At the beginning of the century, this decline was primarily influenced by changing social conditions such as major improvements in nutrition and sanitation. Implementation of programs to increase access to medical care also contributed to a continued decline in infant deaths. Since the late 1960's, dramatic declines in deaths of newborns have been associated with organizational changes to deliver intensive care to high risk newborns through specialized regional centers.

Childhood deaths from infectious diseases have also declined since the introduction of immunizations against common childhood communicable diseases such as poliomyelitis, measles, and pertussis.(1) In addition, improvements in the diagnosis and treatment of chronic childhood disorders have resulted in increased life expectancy for children with chronic diseases such as cystic fibrosis, leukemia, heart defects and kidney failure.(2)

The success of disease prevention and amelioration stands in contrast with injury control. For example, deaths from diseases among children ages 1-4 were eight times as common as injury deaths in 1930, but by 1980 the death rates from diseases and injuries were at a similar level. For adolescents and young adults (ages 15-24) the injury death rate was almost three times that for diseases by 1980, whereas the opposite was true 50 years earlier.(3)

Changes in childhood mortality in Massachusetts reflect these national trends. Between 1940 and 1980 the Massachusetts infant mortality rate declined 72% from 37.5 to 10.3 deaths per 1000 live births. A decline of 55% occurred over the past 20 years alone (1965-1984). There has also been a dramatic decline in the death rates of children ages 1-14 over the last 35 years. Among 1-4 year olds the death rate declined 61%, death rates for children 5-9 declined 48%, and among 10-14 year olds there was a decline of 42%. In contrast, the adolescent death rate has remained persistently high and has increased slightly in the last 35 years.(4) Today, the death rate among adolescents is higher than for any other age group of children over the age of one, and is due to the predominance of injuries as a leading cause of death in this age group.

CAUSES OF DEATH THROUGHOUT CHILDHOOD 1980 - 1984

Deaths in infancy

During the period 1980 to 1984, there were 3603 deaths of infants under one year of age for an average of about 720 infant deaths per year. Eighty-six percent of the deaths (3090) were attributed to conditions originating in the perinatal period, to congenital anomalies, and to Sudden Infant Death Syndrome (SIDS). Although deaths occurring over the age of one can also be assigned to these causes, the majority of deaths resulting from each of these three categories takes place in infancy. Ninety-nine percent of deaths from perinatal conditions, 82% of deaths due to congenital anomalies and 97% of SIDS deaths occurred before the first birthday. In addition, 12%

of infants died of other medical causes such as respiratory disease and diseases of the circulatory and nervous systems. In the same five year period, 75 infants (2%) died of injuries, mainly unintentional injuries such as suffocation (25), motor vehicle accidents (8), fire (7) and other unintentional injuries (24). Eleven infants were reported by vital statistics as victims of homicide.

Deaths in children and adolescents 1-19 years of age

Infectious diseases are no longer the leading cause of death among children. Only 1.7% of deaths to children 1-19 years of age was attributed to infectious or parasitic disease during 1980-1984. Deaths and death rates for leading causes of death in this age group are presented in Table 1.

Table 1 DEATHS AND DEATH RATES* OF CHILDREN 1-19 BY AGE AND CAUSE, MASSACHUSETTS 1980-1984

	AGE				
CAUSES	1-4	5-9	10-14	15-19	1-19
	(Age Specific Rates per 100,000 Population)				
All Causes	41.4	21.5	20.8	67.4	39.8
Malignant Neoplasms	5.0	3.9	3.4	5.0	4.3
Congenital Anomalies	6.5	1.3	1.5	1.5	2.3
Circulatory Diseases	2.8	1.5	1.1	2.4	1.9
Other Medical	15.0	5.2	5.3	7.7	7.8
Motor Vehicle Injuries	2.3	4.3	4.0	29.6	12.1
Suicide	0	0	0.7	6.4	2.3
Homicide	1.1	0.9	0.7	4.9	2.2
Other Injuries	8.7	4.3	4.1	9.9	6.9
	(Average Number of Deaths per Year 1980-1984)				
All Causes	116	74	90	343	623
Malignant Neoplasms	14	13	15	26	68
Congenital Anomalies	18	4	7	8	37
Circulatory Diseases	8	5	5	12	30
Other Medical	42	18	23	39	122
Motor Vehicle Injuries	6	15	17	151	189
Suicide	0	0	3	32	35
Homicide	3	3	3	25	34
Other Injuries	24	15	18	50	108

*Rates per 100,000 children 1-19 (population estimates for 1981-1984 were prepared by the Child Death Study). See Appendix B for method.

The largest category of medical conditions and the one which elicits the greatest amount of fear in parents is cancer. However, malignant neoplasms (cancer), primarily childhood leukemia, accounted for only 11% of deaths in this age group. Birth defects are also an important cause of death in childhood, particularly among young children 1-4 years of age. Diseases of the circulatory, nervous, and respiratory systems accounted together for nearly one third of all deaths due to medical conditions.

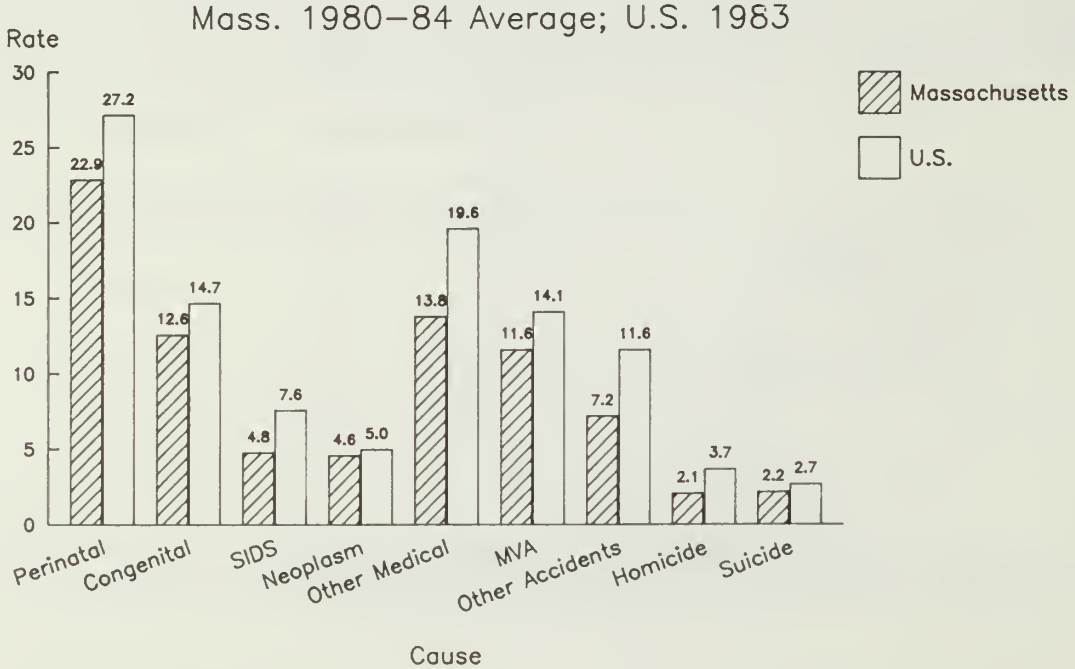
Although the proportion of deaths attributable to any one cause varies by age, injuries related to motor vehicles, including collisions with pedestrians and bicycles, stand out as by far the most serious cause of childhood mortality. Thirty percent of all child deaths and more than half of all injury deaths were motor vehicle-related. Other important causes of injury deaths were fire, drowning, and suffocation among young children; and violence, namely suicide and homicide, among adolescents 15-19 years of age.

Among adolescents, deaths from violence were more than twice as common as deaths from cancer. Together, suicide and homicide accounted for 17% of all deaths among youth 15-19 years of age.

COMPARISON OF MASSACHUSETTS AND U.S. RATES

Massachusetts children had lower death rates than the total United States child population (Chart B).

Chart B.
Comparison of Massachusetts and U.S. Cause Specific Death Rates* Per Children 0–19
Mass. 1980–84 Average; U.S. 1983



* Rates per 100,000 children 0 – 19
(Population estimates for 1981–84 prepared by the Child Mortality Study based on 1980 census)

The more favorable health status of Massachusetts children, as measured by death rates, was observed for all causes of death as well as for each age group of children. The United States average rate for 1983, 109 deaths per 100,000 children 0-19, was 33% higher than the 1980-1984 Massachusetts rate of 82 child deaths per 100,000.

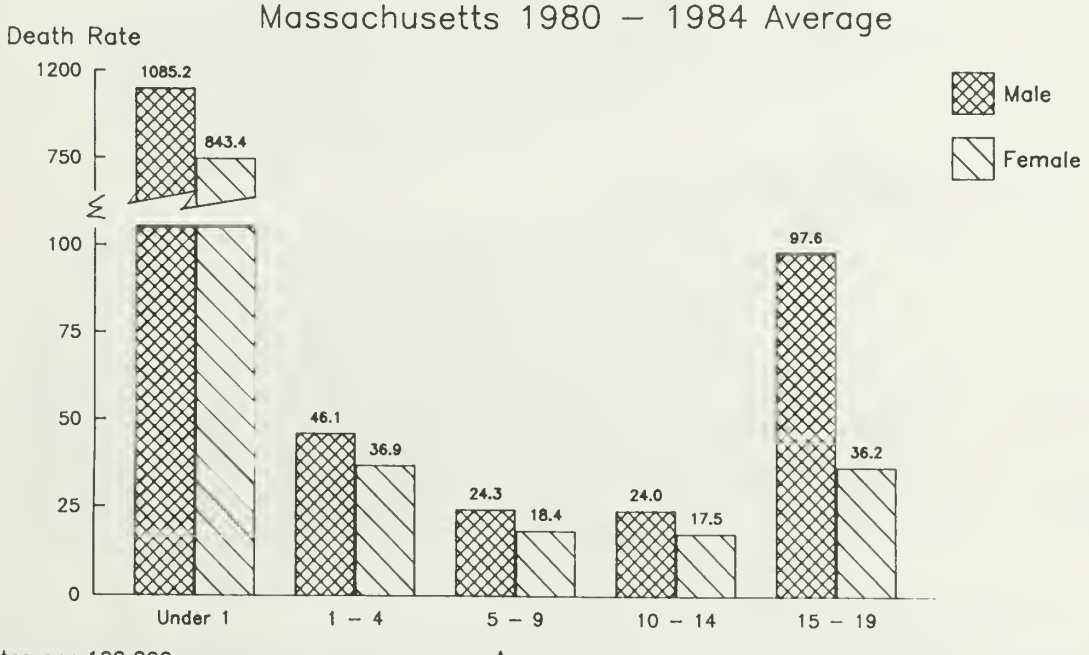
DIFFERENTIALS IN CHILDHOOD MORTALITY

In spite of the overall decline in childhood mortality during recent decades, differentials in mortality rates among groups of children persist. These differentials provide clues for future preventive efforts aimed at further improving the health of children in the Commonwealth.

Differentials by age and sex

As Chart C illustrates, the two age groups with the highest death rates are infants under age one and adolescents 15-19 years old. Males die at a higher rate than females throughout childhood but the disparity is particularly striking in adolescence, where the death rate for males is more than 2.5 times the rate for females. This large differential in adolescence is due to the higher rate of injury death among males. Indeed, while males accounted for 57% of all medical-related deaths, they were the victims in 74% of all injury deaths.

Chart C.
Child Death Rates* (from all causes) by Age and Sex
Massachusetts 1980 – 1984 Average

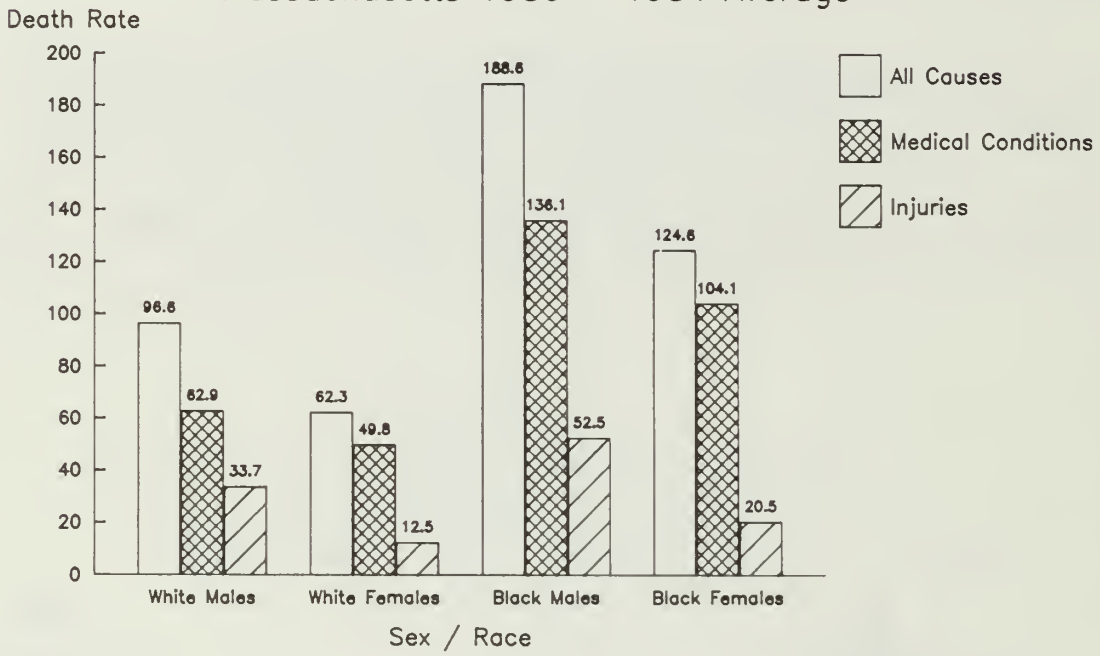


* Rates per 100,000
(Population estimates by age for 1981–1984 prepared by the Child Mortality Study based on the 1980 census)

Differentials by race

Mortality risk in Massachusetts was twice as high for black children as for white children, although black children accounted for only 10% of total child deaths during 1980-84. The disparity in death rates between black and white children is evident for both females and males (Chart D).

Chart D.
Death Rates of Children 0 – 19 by Sex, Race, and Cause of Death
Massachusetts 1980 – 1984 Average



* Rates per 100,000
(Population estimates for 1981–84 prepared by the Child Mortality Study)

Black males had the highest death rates for both injuries and medical conditions. They were the only group of Massachusetts children which compared unfavorably with national statistics for 1983, having had a higher rate of death from all causes than their counterparts in the total United States population. Similar analysis for Hispanic children was not performed because vital statistics information on ethnicity was inconsistent.

Differentials by geographic location

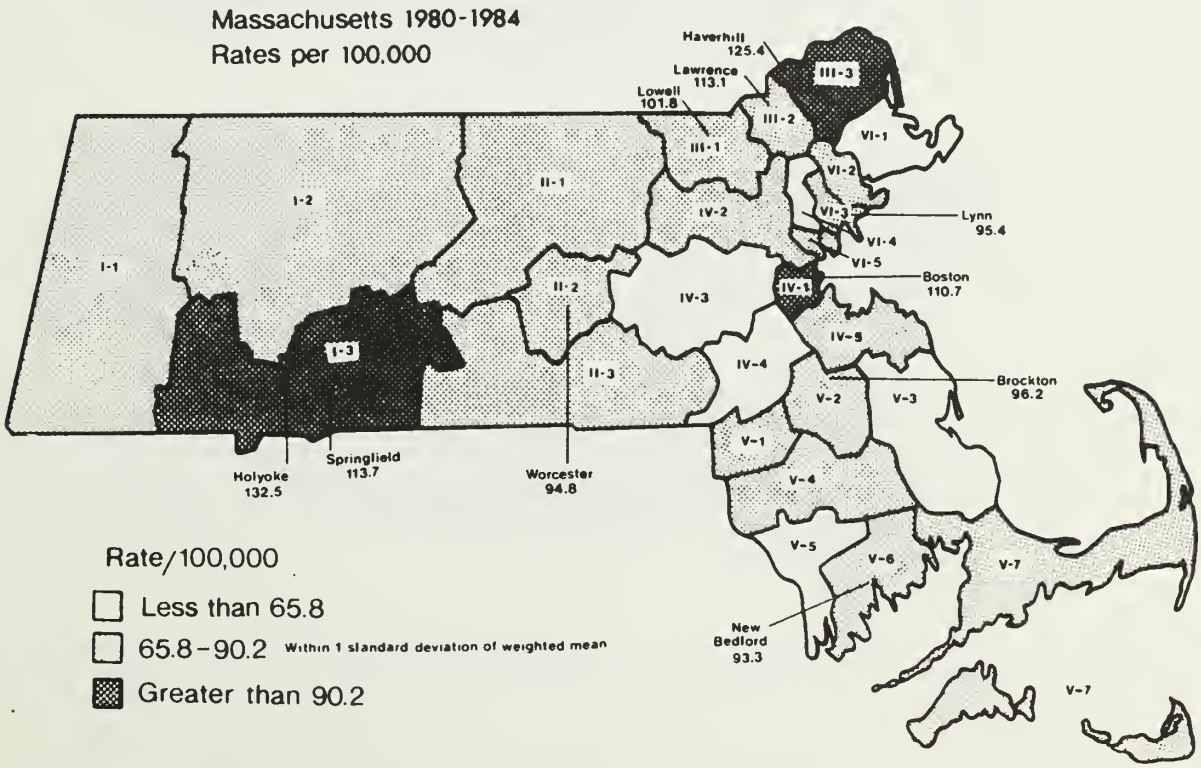
Disparity in childhood mortality among different areas and communities in Massachusetts is illustrated in the following map and in Table 2.

TABLE 2: DEATH RATES* FOR CHILDREN 0-19
FOR THE 25 CITIES WITH THE LARGEST POPULATION OF CHILDREN
MASSACHUSETTS 1980-1984

City	5 Year Average Rate 1980-1984	Number of Child Deaths 1980-1984
Holyoke	132.5	92
Haverhill	125.4	90
Springfield	113.3	274
Lawrence	113.1	115
Boston	110.7	837
Lowell	101.8	152
Brockton	96.2	154
Lynn	95.4	109
Worcester	94.8	221
New Bedford	93.3	136
Taunton	88.4	61
Chicopee	85.2	67
Billerica	83.2	59
Quincy	81.9	86
Massachusetts	78.0	6717
Fall River	75.4	105
Medford	74.5	60
Cambridge	73.3	77
Malden	72.1	51
Framingham	68.3	63
Pittsfield	67.1	53
Peabody	66.5	46
Somerville	65.4	65
Waltham	61.3	47
Weymouth	55.9	47
Newton	50.2	56

* rate per 100,000 children age 0-19 (population denominators by city and town were based on the 1980 census for the entire 5-year period)

DEATH RATES* for CHILDREN 0-19 YEARS by HEALTH SERVICE AREAS & TEN CITIES WITH THE HIGHEST RATES



State Childhood Death Rate = 78.0/100,000

When child death rates are examined for the 25 cities and towns with the largest child populations, the highest rate, found in Holyoke, is 2.6 times the rate of the city of Newton. A similar pattern of gaps in infant mortality in the state was identified by the 1985 Report of the Task Force on Prevention of Low Birthweight and Infant Mortality. That report also pointed out that the Massachusetts communities with the highest rates of low birthweights and infant mortality were also those with the highest proportion of the poor.(5) The association between poverty and mortality throughout childhood will be discussed in Chapter III where findings of the 1985 Study are presented.

SUMMARY

- In Massachusetts, the infant mortality rate and death rates of children 1-14 years of age have declined dramatically over the last 35 years, but the death rate of adolescents 15-19 has remained persistently high.

- After the first year of life, injuries have emerged as leading causes of death among children The proportion of deaths from injuries increases with age. Among adolescents 15-19 years of age, injuries accounted for 75% of all deaths during the period of 1980 to 1984.

- Death rates of Massachusetts children were lower than the national average for all age groups and for both medical-related and injury deaths. However, one group of children in Massachusetts, black males, had a higher death rate than the national average for black male children.

- Differentials in childhood mortality among Massachusetts children persist. For example, during the five year period from 1980 to 1984:

  - the death rate of adolescent males 15-19 years was two and a half times the rate for adolescent females.

  - the death rate of black children 0-19 years was twice the rate for white children of the same age.

  - there was a large gap in child death rates between communities with high rates of poverty and wealthier communities.

CHAPTER III. CHILD DEATHS IN MASSACHUSETTS 1985: GENERAL FINDINGS

The Child Death Study identified 1332 deaths to Massachusetts resident children that occurred during the 1985 calendar year. Although most of these children died in Massachusetts, 98 died out of state. Out-of-state deaths were included in the analysis. These numbers differ slightly from the official Massachusetts vital statistics for 1985 because the Study's surveillance of newspaper reports and obituaries identified additional deaths of Massachusetts children for whom death certificates were not received by the Registry of Vital Records.* The additional research carried out during this study was also used to correct minor discrepancies in the data provided on the death certificates. Therefore, when trends in child deaths are discussed in this chapter, the official 1985 vital statistics are presented to assure consistency with preceding years.

TRENDS IN CHILDREN'S DEATHS

There has been a steady decline in the absolute number of child deaths between 1980 and 1984, as revealed in Table 3. The death rate for children 1 - 19 years of age showed a small but steady decline from a high rate of 41.3 per 100,000 in 1981 to a low rate of 38.1 per 100,000 in 1984. In 1985, the total number of deaths increased as compared to 1983 and 1984, yet remained below the total for the three previous years (1980 - 1982).** In addition, the number of 1985 child deaths is below the average number of deaths for the years 1980-1984.

The increase in 1985 is largely explained by the infant mortality rate (from 8.9 infant deaths per 1000 live births in 1984 to 9.1 in 1985). This issue has been addressed through the work of the Task Force on Prevention of Low Birthweight and Infant Mortality. For children ages 1 - 19, the increase of 9 deaths in 1985 from 1984, was due entirely to the increase in trauma from injuries, as illustrated by Table 4.

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* Included in these records are children who died out of the United States. Such records are never received by Massachusetts. Also included in this number were deaths whose records had not yet met the legal requirements for filing due to significant missing information.

** Although the Study did not analyze 1986 data in detail, a subsequent review of the 1986 Vital Statistics reveals that the total number of deaths in 1986 was 1266, a decline of deaths for children of all ages.

Table 3 TRENDS IN INFANT MORTALITY AND CHILD DEATH
MASSACHUSETTS 1980 - 1985 (VITAL STATISTICS)

	All Children	Infant Mortality (under age 1)		Child Deaths (age 1-19)	
Year	# of Deaths	# of Deaths	Rate*	# of Deaths	Rate**
1980	1422	748	10.3	674	40.9
1981	1371	710	9.6	661	41.3
1982	1375	764	10.1	611	39.2
1983	1281	682	9.0	599	39.3
1984	1268	699	8.9	569	38.1
1985	1323	745	9.1	578	39.0
1986	1266	695	8.4	571	***

* Infant deaths per 1000 live births.

** Child deaths per 100,000 resident children. (Annual population estimates by age were developed by the Child Death Study.)

*** Rate not calculated at time of printing.

Table 4 TRENDS IN DEATHS OF CHILDREN AGE 1-19
BY CAUSE OF DEATH, MASSACHUSETTS 1980-1985 (VITAL STATISTICS)

		Medical Conditions		Injuries	
Year	Total # of Deaths	# of Deaths	% of Total	# of Deaths	% of Total
1980-1984 average	622.8	256.2	41.1%	366.6	58.9
1984	569	239	42.0	330	58.0
1985	578	213	36.9	365	63.1

While deaths from medical disorders in this age group declined to the lowest number since 1980, the number of injury-related deaths increased 10.6% between 1984 and 1985. The dramatic toll taken by violence and injuries among children and adolescents underscores the need to monitor these events closely as part of an overall effort to develop preventive strategies.

As Table 5 demonstrates, although the number of deaths of white children remains high, the number of deaths of black children increased by almost 50% between 1984 and 1985. The percent increase in deaths among black children was somewhat higher for infants (53.7% increase) but was also substantial among children over age 1 (41.9% increase for children 1-19).

Table 5 DEATHS AND DEATH RATES OF CHILDREN AGE 0-19 BY RACE MASSACHUSETTS 1984 AND 1985 (VITAL STATISTICS)

Race	1984 #	1984 Rate**	1985 #	1985 Rate	% Change 1984/1985 #	% Change 1984/1985 Rate
White*	1118	78.9	1116	81.0	-0.2%	+2.7%
Black	125	144.3	187	201.0	+49.6%	+39.3%
Other and Unknown	25	38.6	20	23.11	-20.0%	-40.1%
Total	1268	80.8	1323	85.0	+4.3%	+5.2%

*White includes those deaths identified as Hispanic in accordance with vital statistics conventions for certifying race. However, there is not a separate item for ethnicity. If an Hispanic child were identified as black, the death would be counted as black. For this reason, similar analysis for Hispanic children was not done.

**Rates per 100,000 children 0-19 (population estimates for 1984 were prepared by the Child Death Study; 1985 denominators are based on projections by the Massachusetts Institute for Social and Economic Research, U.Mass. Amherst).

The same table also reveals that death rates, which take into account changes in the composition of the child population, increased for both white and black children from 1984 to 1985. Overall, there was a five percent increase in the death rate of children, due largely to the infant mortality rate already described in previous studies. However, the rate increase of 39.3% for black children was substantially higher than the 2.7% rate increase for white children.

During the five-year period of 1980-1984, the death rate of black children 0-19 years of age was almost double the rate of white children (156.8 per 100,000 for blacks, 79.8 for whites). This serious gap in the prospect of survival for black children as compared with their white counterparts became wider in 1985, when the death rate of black children was 2.5 times the rate for whites.

The increased disparity in childhood death between white and black children of all ages requires that monitoring and prevention efforts be expanded beyond infancy to include older children and adolescents.

SUMMARY

- According to official statistics, there were 55 more deaths of children ages 0-19 during 1985 than in 1984, a 5.2% increase in the death rate of all children. This increase is largely due to the infant mortality rate; for children ages 1-19, there were 9 more deaths in 1985 than 1984, these resulted from injury.

- In general, the trend in children's deaths for 1980 - 1986 shows a fairly typical pattern of decreasing deaths, with the exception of the infant mortality rate for 1985.

- Among children age 1-19, deaths from injuries increased while deaths related to medical conditions declined.

- During 1985 the death rate of black children age 0-19 increased 39.3% while the rate for white children increased 2.7%.

DEMOGRAPHIC CHARACTERISTICS OF CHILDREN WHO DIED IN 1985

The Study's findings about the sex, age, and race patterns among deceased children were consistent with official statistics for 1985, while findings on ethnicity were materially different. This section describes who died in 1985, based on the Study's findings.

Sex and age

As mentioned in Chapter II, males are at a higher risk of death for all causes of death. The disparity between males and females is much greater for deaths due to injuries than for medical-related deaths (Table 6). The risk for males is highest during adolescence because three out of four deaths in this age group result from injury (unintentionally or intentionally inflicted). In 1985 the Study identified 255 injury deaths of adolescents 15-19 years old of whom 200 were teenage boys (78.4%). Overall, infants accounted for 56.3% of all deaths, children between the age of 1 and 14 accounted for 18.5% of all deaths, and adolescents 15-19 accounted for 25.3% of all deaths.

Table 6 DEATHS OF CHILDREN 0-19 BY SEX AND CAUSE OF DEATH
MASSACHUSETTS 1985 STUDY

Sex	Number of Deaths	All Causes %	Medical Conditions* %	Injuries %
Male	803	60.3	54.6	73.0
Female	529	39.7	45.4	27.0
Total	1332	100%	100%	100%

* includes 6 deaths of unknown cause

Race and ethnicity

When the 1332 deaths were classified in accordance with vital statistics conventions for race, which include Hispanics and Portuguese with whites, Haitians with blacks, and Asians with other, the Study found that 84% were white, 14% were black and 2% were other or unknown. As black children comprised only 6% of the total child population, these figures illustrate again the excess mortality among black children in the Commonwealth as compared with whites.

The Child Mortality Study reclassified ethnicity because death certificates did not contain separate items for recording race and ethnic origin. To assign ethnic origin, the Study coders looked at additional types of information, such as the place of birth of the child or the child's parent

and references to the child's ethnic origin in reports obtained for the record. Comparison with official statistics reveals that the number of deaths of Hispanic children by the Study's count was three times the number reported officially (89 deaths of Hispanic children identified by the Study as compared with 28 by Vital Statistics). (Table 7)

Table 7 NUMBER OF DEATHS OF CHILDREN 0-19
BY ETHNICITY AND CAUSE OF DEATH
MASSACHUSETTS 1985 STUDY

Ethnicity	Cause of Death: All Causes	Medical Conditions*	Injuries
White	1005	689	316
Black	169	124	45
Hispanic	89	65	24
Portuguese	23	15	8
Haitian	19	17	2
Asian	17	12	5
Other & Unknown	10	6	4
Total	1332	928	404

* includes six deaths of unknown cause

No data were available to compare or analyze the 19 deaths recorded for Haitian children, and 23 deaths of Portuguese children, because vital statistics do not report these categories.

Identifying child health risks for specific ethnic groups is very important because population trends both nationally and in Massachusetts indicate that the proportion of minorities among the young is increasing.(2) Since child poverty and adverse health outcomes are disproportionately found among non-white populations, improved targeting of preventive programs would require better vital events information by ethnicity. Some progress has already been made in this area, as a new item for ethnicity (in addition to race) was introduced on all birth certificates as of June 1986, and will be introduced on death certificates in January 1989.

SUMMARY

- The findings of the 1985 Study with respect to the sex, age, and racial patterns among deceased children were consistent with official statistics for 1985 and mirror earlier findings from the 1980-1984 analysis.

- Due to the additional information available to the Study, findings on ethnicity were materially different from official figures. The Study identified 89 deaths of Hispanic children, three times the number reported by vital statistics.

CAUSES OF DEATH AMONG CHILDREN IN 1985

Causes of death were independently coded for this Study using the International Classification of Diseases, Ninth Edition and relying on several sources of information for assigning cause of death codes. These additional sources included, for example, abstracts of medical records or autopsy reports for medical cases; and police, fire, coroner, or media reports for injury cases.*

Naturally, it would be expected that coding based on multiple data sources would yield a different and, hopefully, a more accurate determination of cause of death. At the same time, differences in the coding methods of the Study and vital statistics may also account for some of the observed discrepancies.

Table 8 presents the causes of child deaths in 1985 as coded by the Study. Several observations can be made. In reviewing deaths due to medical conditions, it is evident that almost 8 out of 10 children who died from such causes were infants. Three major groups of conditions, i.e. certain conditions originating in the perinatal period, birth defects (congenital anomalies), and Sudden Infant Death Syndrome (SIDS), accounted for 90% of all medical-related deaths in infancy. After infancy, deaths from medical conditions declined markedly as a proportion of total deaths and were mainly the result of chronic conditions such as cancer, birth defects, and other chronic disorders of the heart, lung, kidneys, central nervous system, etc. The Study identified only 13 deaths that were due to infectious or parasitic disease, less than 1% of all deaths to children ages 0-19 during 1985.

*The only group for which the Study did not independently code the cause of death was a group of 533 newborns who died within 28 days of birth from non-injury causes. Since medical records were not reviewed for these neonates, vital statistics death codes were accepted and recorded for them.

Table 8 1985 CHILD DEATHS BY AGE AND CAUSE
AS CODED BY CHILD DEATH STUDY

Cause of Death	All Children	Under 1	1-4	5-9	10-14	15-19
Total Medical Conditions	922	727	64	23	27	81
Perinatal Conditions	378	378	-	-	-	-
Congenital Anomalies	234	200	16	4	4	10
SIDS	84	81	3	-	-	-
Cancer	65	2	14	9	11	29
Infection	13	6	5	-	-	2
Disease of Nervous System	33	6	9	3	4	11
Disease of Circulation/Blood	59	24	11	4	3	17
Other medical	56	30	6	3	5	12
Total Injuries	404	18	46	26	59	255
Motor Vehicle-Related*	210	1	16	14	29	150
Drowning	25	1	7	5	5	7
Fire	18	1	7	5	4	1
Suffocation	11	3	4	1	1	2
Poisoning	10	-	2	-	2	6
Fall	7	-	2	-	1	4
Other Accident	18	1	2	-	5	10
Suicide	61	-	-	-	8	53
Homicide	44	11	6	1	4	22
Unknown Cause	6	5	-	-	-	1
All Deaths	1332	750	110	49	86	337

* Motor vehicle-related deaths include motor vehicle collisions with pedestrians and bicycles.

Deaths from injuries accounted for two thirds of all child deaths in the 1-19 age group. Of the total 404 injury deaths to all children, more than half (52%) were related to motor vehicle accidents, including 24 pedestrians and 15 bicyclists struck by motor vehicles. More than a quarter of injury deaths (26%) resulted from intentional acts, namely suicide (15%) and homicide (11%). All other causes of injuries combined accounted for the remaining 22%. Thus, motor vehicle accidents, suicide, and homicide are the leading causes of injury deaths in childhood. These three causes are of special concern with regard to adolescents because 88% of all injury deaths in the 15-19 age group resulted from motor vehicle accidents, suicide, or homicide.

When the Study's findings were compared with official figures for 1985 and for the five preceding years, the following observations emerge.

First, the increase in deaths of children 1-19 years of age between 1984 and 1985 reflects an increase in injury deaths, as noted in the first part of this chapter. Both the Study's findings and vital statistics figures show a decline in deaths from medical conditions and an increase in injury deaths, particularly in motor vehicle accidents and suicides.

The second observation relates to official undercounts of injury-causation for deaths in general, and violent-causation for deaths in particular. For example, the Study identified 11 cases of infant homicides in 1985 of which only six were reported as homicides by vital statistics, an 83% undercounting of homicide in this age group. For the five years preceding 1985, 11 infant homicides were reported by vital statistics, a number identical to the Study's finding for one year alone. With respect to injuries to children 1-19 years old, the Study identified 22 more injury cases than officially reported. The largest proportion of discrepancy was in violent deaths (suicides and homicides), which together reveal a 22% underreport by vital statistics.*

Discrepancies in the other direction, that is, overcounting of injuries, was of a smaller magnitude. Overall, the findings of this Study support other research in demonstrating that injuries and violent deaths are underreported. Further, the Study provides data to quantify the scope of this undercount. Chapter IV, which is devoted to injuries, discusses this topic in more detail.

SUMMARY

- In 1985, less than 1% of all deaths to children (ages 0-19) was due to infectious or parasitic disease, a dramatic decline from several decades ago.

- In 1985, two-thirds of all deaths to children age 1-19 were due to injuries.

- Injuries in general, and violence in particular, are underreported by official statistics as causes of death. Homicide among infants was undercounted by 83%. Altogether, suicides and homicides among all children were undercounted by 22%. This discrepancy reflects a problem with the vital statistics reports rather than the response of the system of investigation.

POVERTY AND CHILD DEATHS

The relationship between poverty and excess mortality has been well documented for adults and for infants. Studies show that persons from lower socioeconomic groups experience higher rates of death.

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*All death certificates for violent deaths are filed by medical examiners. When the initial certificate is filed, the manner of death is often classified as "undetermined" or "pending investigation." The classification of suicide or homicide may not be available until many months after the death and may, in some cases, depend upon final court action. If the death certificate is filed as a "pending investigation," follow up activities will occur by the Registry until a final certificate is filed. This may take up to 15 months after the death.

However, the effect of poverty on mortality throughout childhood - for children over one year of age and for teenagers - has been a neglected topic of research. The reason for this neglect has been the absence of readily available data to measure poverty in relation to child death.[3][4] Two approaches were used in this Study to examine the relationship between poverty and child deaths. Following the idea of a 1983 child death study in Maine,[5] which defined poor children as children receiving public assistance benefits, a limited computer match was conducted between the Massachusetts 1985 child death list and program participation files of the Department of Public Welfare. Children under seven days of age were omitted from the analysis because sufficient information was not available to make a reliable match. The match revealed that of 878 deceased children over seven days of age, 32% were listed on program participation files of the Department of Public Welfare (DPW).

The data show that among the children who died during 1985, high proportions of young children, particularly children under age 5, were known to DPW, (40% of children under 1, and 45% of children 1-4). Analysis by cause of death reveals that 50% of children who died in fires, 41% of medical-related deaths, and 39% of homicide victims, were known to DPW. These figures on DPW program participation, which serve as a proxy for poverty, supported the importance of conducting further analysis*.

The second method used by this Study to look at poverty and child death was modeled on a study of child deaths in the city of Boston conducted by Wise et al.[6] which relied on census tract information as an indirect measure of income. Median family income by census tract of residence was used as a measure of economic resources available to the family of the deceased child. A census tract is a small geographic unit consisting of approximately 10,000 residents or less. In Massachusetts about 95% of the population in 1980 lived in areas that are tracted. For this Study, census tract address indices as well as maps were used to code the addresses of deceased children. Median family income for each census tract was obtained from the 1980 national census. The census tracts were then ranked by median income and stratified into three groups.

The 1980 poverty cut-offs for a family of four were used as a basis for grouping. The three groups are as follows:

- Group 1, defined as "low income" based on median census tract income of less than 200% of 1980 poverty level.

- Group 2, defined as "middle income" based on median income of between 200% and 300% of poverty level.

- Group 3, defined as "high income" based on a median income of more than 300% of poverty level.

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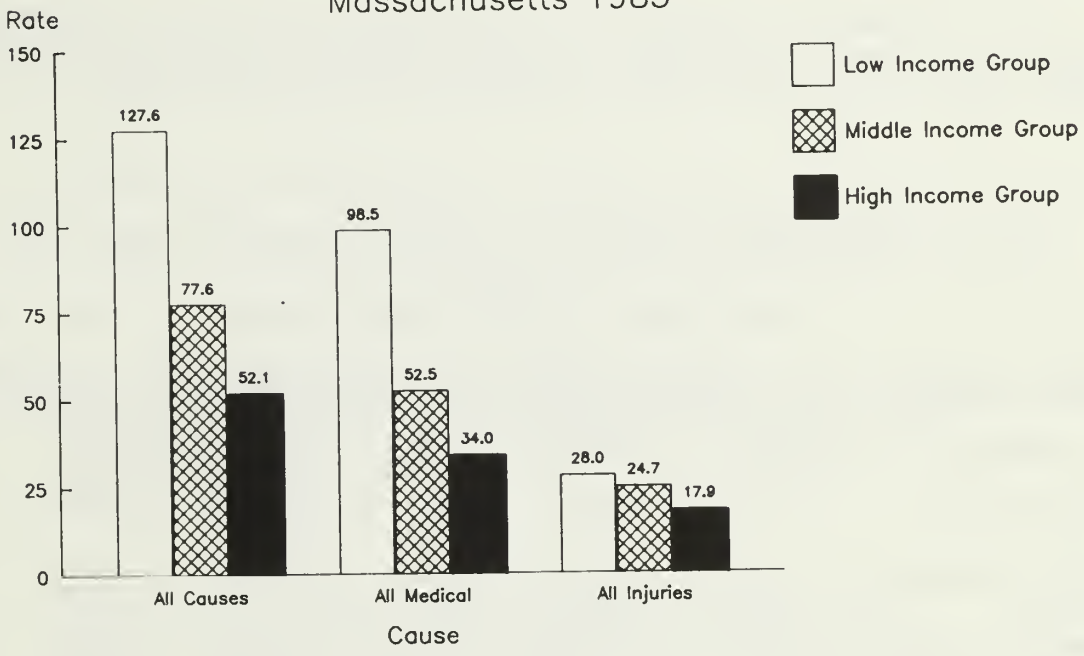
* The figures on program participation are considered underestimates because a limited manual check showed that some children were missed during the matching process. Parents' names were not checked independently of child's name, as was done in the Maine Study.

In 1980, 16% of Massachusetts children lived in low income census tracts (Group 1), 49% lived in middle income census tracts (Group 2), and 35% lived in high income census tracts (Group 3).

Death rates were calculated by income group as well as by age and cause of death. Findings are presented in Chart E and in Tables 9 and 10.

Chart E.
Death Rates* of Children 0 – 19 by Cause and Income Group
Massachusetts 1985



* Rates per 100,000
(Population denominators based on the 1980 census)

The data provide persuasive evidence of the gap in childhood mortality between poor and non-poor children. For all causes combined, the rate of death for children in the low income group was 2.4 times higher than the rate of the high income group. The disparity is evident for both injuries and medical conditions. Specific causes of death with high disparity between poor and non-poor children are perinatal conditions, SIDS and other medical conditions, as well as homicide and other non-motor vehicle injuries. Motor vehicle accident victims deviate from the general pattern of the lowest death

rates occurring among the high income group. It is the only cause of death for which low income children were at an advantage. The highest rate of motor vehicle deaths is observed for the middle income group, suggesting that access to motor vehicles, particularly by teens, is the overriding factor in these deaths. In the case of suicide, the commonly held view that suicide is more prevalent among wealthy, high achieving youth is not borne out by the figures. Although the highest rate is observed for the middle income group, the rate is also lowest for the high income group.

Consistent with what is already known for adults and infants, differentials in mortality by income group are evident throughout childhood, with a higher death rate for the low income group at each age, except for adolescents. Among 15-19 year olds the rate was highest in the middle income group, a fact accounted for by the predominance of motor vehicle deaths in this age group.

Thus, although the Study does not establish a causal relationship between income levels and risk of death, it does suggest that different income groups appear to be at increased risk of death due to selected causes.

Table 9 MASSACHUSETTS CHILDREN'S DEATHS BY CAUSE AND INCOME LEVEL, 1985

	Low Income		Middle Income		High Income	
Cause of Death	N	Rate/100,000	N	Rate/100,000	N	Rate/100,000
All Causes	337	127.6***	625	77.6***	306	52.1
All Injuries	74	28.0**	199	24.7**	105	17.9
Vehicle-Related	22	8.3	106	13.2	66	11.2
Suicide	10	3.8	34	4.2	15	2.6
Homicide	22	8.0***	15	1.9	4	a
Other Injuries	20	7.6**	44	5.5	20	3.4
All Medical	261	98.8***	423	52.5***	200	34.0
Congenital	47	17.8**	114	14.1	63	10.7
Perinatal	126	47.7***	176	21.8***	67	11.4
SIDS	30	11.4***	32	4.0	19	3.2
Cancer	10	3.8	37	4.6	14	2.4
Circulation/Blood	20	7.6***	22	2.7	13	2.2
Other Medical	28	10.6***	42	5.2	24	4.1

** Rate compared to High Income statistically significant at the .01 level.

*** Rate compared to High Income statistically significant at the .001 level.

a - Number too small for rate calculation in the High Income group, therefore, rate was compared with the Middle Income group.

Table 10 MASSACHUSETTS CHILDREN'S DEATHS BY AGE AND INCOME LEVEL, 1985

	Low Income		Middle Income		High Income	
Age	N	Rate/100,000	N	Rate/100,000	N	Rate/100,000
0-19 years	337	127.6***	625	77.6***	306	52.1
0-less than 1 yr.	222	1712.4***	351	1005.2**	152	768.1
1-4 years	33	71.3**	44	34.2	26	32.1
5-9 years	11	19.1	25	14.3	10	7.9
10-14 years	17	27.4	34	15.8	30	17.7
15-19 years	54	63.4	171	67.8**	88	46.0

** Rate compared to High Income statistically significant at the .01 level.

*** Rate compared to High Income statistically significant at the .001 level.

SUMMARY

- Analysis of poverty and child death in 1985 reveals a large gap between children who lived in low income areas of Massachusetts and those children who lived in affluent localities.

- Disparities in death rates between children from low income and high income areas were particularly high for infants and children under age 5, and for children who died of perinatal conditions, SIDS, and other medical conditions, as well as homicide and other non-motor vehicle injuries.

- Motor vehicle-related deaths deviated from the general pattern. Motor vehicle-related death rates for children from middle and high income areas were higher than for poor children. Similarly, among adolescents, the highest rate was among the middle income group.

CONTACT WITH PUBLIC AGENCIES SERVING CHILDREN

Psychosocial problems such as child abuse, depression, substance abuse, self-destructive behavior, criminal activity, and severe mental or physical disability have often been mentioned as factors which may be associated with increased risk for injury or death. Although this Study was not designed to test whether such associations exist, an attempt was made to explore the role of certain social risk factors in relation to various causes of death, particularly injury-related deaths. Public agencies serving children come in contact with the most vulnerable segment of the child population. They often serve children who do not reach private sources of care, children who have physical or mental disabilities, and children whose entry into the public system is involuntary (i.e., through a court referral or a child abuse report).

The Child Death Study conducted a record search at three major public agencies serving children: The Department of Social Services (DSS), the Department of Youth Services (DYS), and the Department of Mental Health (DMH). Prior contact with agencies may indicate personal or family problems which these agencies usually address. In addition, information about the frequency with which public agencies came in contact with children who later died could be helpful in assessing the future role of public agencies in regard to prevention efforts. The names of all the children who died in 1985 were checked at DSS, but for the two other agencies (DYS and DMH) only the names of children ages 9-19 were searched*.

The first objective of the search was to ascertain the proportion of deceased children who had contact with a state agency *at any time prior to death.* The second objective of the search was to collect information about the social history of the child and about services provided to those children who were known to public agencies. This information supplemented similar data obtained from other sources and was used to construct measures of social risk and access to social and mental health services for the Study's subjects. Discussion of social risk and its prevalence among children who died of trauma is detailed in the chapter devoted to injuries. In this section, the frequency of prior contact with state agencies is presented and discussed.

In total, there were 168 children who were found to be known to at least one state agency. Of these 168 children, 139 were known to one agency, 24 were known to two agencies and 5 children were known to all three. (147 children had prior contact with DSS, 41 had contact with DMH and 14 were known to DYS.)

Table 11 presents data about the 9-19 age group whose names were checked at all three agencies (DSS, DYS, and DMH).

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* DYS does not serve children under age 9. DMH officials suggested the age 9 cutoff because few younger children are served by the mental health system.

Table 11 NUMBER AND PERCENT OF CHILDREN 9-19 YEARS OLD WITH PRIOR CONTACT WITH AT LEAST ONE STATE AGENCY, BY CAUSE OF DEATH

	Children 9-19		
		Prior Contact	
Cause of Death	Total Deaths	N	%
Medical Conditions	111	29	26.1%
All Injuries	319	60	18.8%
Suicide	61	16	26.2%
Homicide	27	10	37.0%
MVA	187	26	13.9%
Other Injuries	49	8	16.3%
All Causes	430	89	20.7%

The table indicates that a fifth of the children in the 9-19 age group had prior contact with a state agency at some point in their lives, not necessarily related to the time or cause of death. Among children who died of homicide, suicide, and medical conditions, higher proportions had prior contact. Although no control group was available for comparison there are some indications that prior contact, and therefore risk, is more prevalent among deceased children than would be expected in the general child population.

For example, a study of adolescents' suicidal behavior conducted in Massachusetts compared prior contact with DSS among suicidal teens ages 13-17 and a control group of adolescents admitted to a hospital for medical reasons. The study found that 15.7% of the suicidal teens had prior contact with DSS compared with 4.4% of the control group. The difference, which was statistically significant, led the researchers to conclude that: "The higher frequency of contact with DSS among the suicidal probands is, at the very least, a marker for a greater burden of disadvantage experienced by these youth."(7) In our Study, 25% of children ages 9-14 and 13% of adolescents 15-19 had prior contact with the Department of Social Services. Among the 1985 teen suicides (ranging in age from 12 to 19), 20% had prior contact with DSS. These figures are comparable and even higher than the ones quoted for the suicidal group in the study mentioned above.

There is another indication that a higher proportion of the Study population had prior contact with DSS than other children in Massachusetts. Among children ages 1 month to 19 years who died in 1985, 15.6% had records on DSS' computer system. If the general child population in Massachusetts had had a similar rate of prior contact with DSS, the expected number of accumulated records on the computer system would have been 242,920. (The estimated number of Massachusetts children 0-19 in 1985 is 1,557,180.) However, the Department estimated that the number of accumulated records on the automated system ranges from about 141,000 records of children under age 18, to 153,200 records of children 0-21 years of age.(8)

Finally, these findings also mean that public agencies serving children do reach an important segment of the child population at risk. Consequently, these agencies provide a potential point for preventive strategies for reducing death and disability among children.

SUMMARY

- Among children 1 month to 19 years old who died in 1985, 16% were identified through a record search as children who had some contact with the Department of Social Services prior to death, (not necessarily for reasons directly related to their death).

- Among children age 9-19 years who died in 1985, 21% were identified through a record search as children who had some contact with at least one of three public agencies serving children (DSS, DYS, or DMH), at some time in their life, prior to death.

- Children who died of homicide, suicide, and medical conditions were more likely to have had a point of contact with at least one state agency than children who died of other causes.

- Prior contact with a state human service agency was more prevalent among the Study population of deceased children than is estimated in the general child population.

"For the last several months Robin acted differently. Used to be very social but now rarely went out; rarely saw friends. Often cried about not having a job, not being in school, and not being close to the family." (Robin committed suicide.)

"Due to Peter's involvement with the selling of marijuana and excessive truancy, he will continue to head toward more serious crimes which will place him in the future at one of the state's correctional institutions." (Peter was murdered.)

"Vicky's friends agreed that they occasionally drink too much and have some problems. But they say there's not much to do. It's a drinking town." (Vicky died in a car crash.)

"Lucy died in a single family housefire. The blaze was caused by careless disposal of smoking material in the first floor livingroom. The only smoke detector was in the basement. A front door was nailed shut and large amounts of trash on the front porch hampered firefighters' attempts to get into the burning house."

"Martin died because of the building owner's negligence in maintaining the building and failing to seal it off from the public. It is not unusual for children to be playing in vacant buildings." (Martin died of a fall.)

The quotes above are taken directly from records abstracted by the Child Death Study, although names and identifying details were changed in order to preserve confidentiality. These examples illustrate the enormous complexity and diversity of factors that contribute to situations of risk and actual harm.

The term 'injuries' has been adopted in recent years by the public health community to replace the use of 'accidents' in describing the causes of fatal and non-fatal events. This shift was made in order to dispel the notion that injuries are caused by random, unpredictable events that are not amenable to prevention. On the contrary, as the material presented in this chapter demonstrates, there are patterns of how, when and where injuries occur, and patterns of who is at higher risk for injury.

The injury chapter contains two sections. In section one, findings will be presented on general patterns of risk among the 404 Massachusetts children who died as a result of injuries in 1985. Section two contains detailed, cause by cause descriptions of the victims, circumstances, and risks associated with each type of injury. It starts with an overview and description of intentional injuries (suicide and homicide) followed by unintentional injuries (motor vehicle-related deaths, drownings, etc.).

SECTION I. GENERAL PATTERNS OF RISK

PATTERNS OF RISK BY AGE

The effectiveness of preventive strategies depends to a large extent on the age and developmental stage of children. Very young children are totally dependent upon their caretakers to provide safe and secure physical and social environments, whereas adolescents are expected to demonstrate independence and to exercise a great deal of judgement in making daily decisions. Older children and adolescents are capable of circumventing physical barriers that protect young children effectively from danger. At the same time older children are expected to "act sensibly," that is, to acquire common knowledge and integrate social norms about the proper reaction to a wide variety of situations. Indeed, the Study's findings suggest that the circumstances surrounding adolescent deaths differ materially from those associated with infants and young children.

Location of injury

Fatal injuries to young children occurred most frequently in a home setting such as the child's home or the home of a relative or sitter, or in the back or front yard of the house. Of all injuries to children under age five, 70% happened in a home or in the vicinity of a home. Nearly half (49%) happened inside the child's own home. Child abuse, fire, suffocation, and drowning were common causes of home injury in this age group.

In contrast, the majority of fatal injuries to teens were sustained away from home, in an outdoor location. Adolescents 15-19 years of age were most likely to be injured in motor vehicle crashes on a road, or in other

unsupervised outdoor locations; 70% of adolescents' injuries occurred in these types of environments. Suicide was an exception since 70% of teen suicides took place in the child's home or the home of a friend or relative.

Supervision at time of injury

The Study looked at the type of activities children were engaged in at the time of injury. For those cases where information was available, it was found that young children were in the care of an adult. There was only one case of a child under age five left alone. In 82% of the cases, children under five years of age were supervised by a parent. Teens, on the other hand, were more likely to have been alone or with friends when the injury occurred. Few fatal injuries happened in formal settings, such as school (1 death), while at work (8 deaths), or during recreational activities (4 deaths).

Time of injury

Although injuries do occur at any time of the day or week, adolescent injuries show a more distinct pattern of greater concentration during unsupervised free time. Forty percent of injuries among older teens (ages 15-19) took place during late night or early morning hours, between 11:00 p.m. and 6 a.m. Almost half of the events that led to death in this age group happened on the weekend (i.e. from 6 p.m. Friday night through 6 a.m. Monday morning). Weekend nights posed a particular risk for adolescents, since more than half of the weekend injuries occurred after 11:00 p.m. In contrast, circumstances that led to the injury of younger children were more evenly distributed throughout the week and hours of the day with no distinct time pattern emerging.

Violations of the law

One of the most striking features of adolescent injuries was the prevalence of not merely risk-taking behavior but actual legal violations associated with the events that led to injury. Information available to the Study from death investigations revealed that half of the 15-19 year old youths who died of injuries were in legal violation at the time of injury. Seven out of ten violations were related to alcohol consumption. Of the toxicology reports available, 45% indicated positive results for alcohol. (Toxicology reports were available for two-thirds of deceased teens ages 15-19.) Other types of violations included trespassing, use of illegal drugs and a variety of violations associated with the operation of motor vehicles.

Conclusion

Two distinct profiles of injury circumstances emerged. Injuries in early childhood generally occurred in home settings when children were in the care of an adult. Risk was increased by the presence of hazards near the home, such as pools, rivers, or busy streets. Adolescent injuries displayed a pattern related to the use of free time, away from formal settings or adult supervision, and associated with illegal and risk-taking behavior, especially in riding and operating motor vehicles.

RISK AFTER INJURY: THE ROLE OF MEDICAL RESPONSE

After an injury has occurred, the chance of survival for the severely injured depends a great deal on timely emergency response, speedy evacuation and optimal management in a hospital equipped to handle trauma patients. Only spotty information was available from records about emergency medical response, i.e., presence of EMT at the scene or mode of transportation to the hospital. However, more complete information was collected about hospitalization. Specific findings about the adequacy of medical response are presented in Chapter VI and will not be detailed here. The analysis in Chapter VI of admission and transfer practices related to child injury deaths reveals that in the majority of child injury cases, access to optimal medical care was provided, and that an informal system of pediatric regionalization of trauma care has developed in Massachusetts.

Despite these encouraging findings about the high level of access to optimal medical care among child injury cases, medical response was irrelevant for many children who died almost instantaneously. More than half of the children who died of injuries in 1985 were either found dead or died within minutes of sustaining injury. Thus, although the role of medical care in saving lives is a crucial one, increased emphasis should be directed at injury prevention.

CAUSE-SPECIFIC RISK: THE ROLE OF INJURY CONTROL MEASURES

The chain of events that lead to injury may be very complex. Yet, some evidence is available regarding the effectiveness of certain measures of protection when a life threatening event does occur. Examples of these measures include smoke alarms and automatic fire extinguishing systems that help to reduce the toll taken by housefires; childproof closures on containers of toxic materials that have greatly reduced fatal poisonings; and restraint systems for occupants of motor vehicles which reduce the severity of injury in a crash.

In order to assess the extent to which fatalities could have been prevented among the 1985 child injury deaths, information about cause-specific risks was analyzed (Table 12). Cause-specific risks were defined as situations of danger, possible danger, or hazards for which reasonable protective measures are known or available. For example, firearms in the home were considered a hazard for gunshot injuries; ready access to controlled substances was considered a hazard for poisoning; alcohol consumption, speeding, and other road violations were considered a hazard for motor vehicle injury, etc.

Although information was not available in all cases, cause-specific risk was found to be present in 233 cases, or 58% of all injury-related deaths. Cause-specific risks were highest for deaths related to motor vehicle accidents, poisoning and suicide. In 72% of the motor vehicle-related deaths, a driver was in violation of the law; in seven out of ten poisonings, controlled drugs were available to the child; in half of the suicide deaths, firearms or controlled medications were available to the teen. The question arises whether these injuries occurred because no protective measures were applied (e.g., fencing around pools, unloading and locking firearms, or using seat belts and helmets) or whether they occurred due to failure of these measures. Unfortunately, consistent data on the subject of protective measures were conspicuously missing from most records available to this Study.

TABLE 12 CAUSE-SPECIFIC INJURY RISK
AMONG CHILD INJURY VICTIMS
MASSACHUSETTS 1985

Cause of Death	Number of Deaths	Child "at risk" % of total	Injury control measures used* % of total
MVA (single vehicle)	96	78%	9%
MVA (multiple vehicle)	75	72%	16%
MVA (ped./bic.)	39	56%	26%
Drowning	25	44%	16%
Fire	18	28%	0
Poison	10	70%	0
Suicide	61	51%	2%
Homicide	44	36%	N.A.
Other Injuries	36	33%	0
Total	404	58%	(9%)

*In most cases, data regarding the use of injury control measures were unavailable.

Criteria used for defining risks/control measures

Cause	Cause-specific risk	Injury control measure
MVA occupant	legal violation by an operator	seat restraints helmet (motorcycle)
MVA pedestrian	violation by MV operator or alcohol use by victim	ped. location off street or crossing at crosswalk/intersection
Drowning	location is hazard, alcohol use by victim, water near home of child under age 6	fence around pool, hazard posted, swimming ability
Fire	code violations	functional smoke detector
Poison	prescribed medicine or illegal drug	medicine locked, childproof or small amount prescribed
Suicide	method used was gun or medication	gun unloaded and locked, medicine as above
Homicide	use of gun, prior assault or threat by perpetrator	N.A.
Other injuries	agent of injury considered a hazard	means used to prevent/ control injury

The findings demonstrate, however, that the majority of injuries happened in circumstances that are amenable to prevention or control by known technologies. Although estimates about the proportion of deaths that can be prevented do vary, the success of certain strategies in saving lives has repeatedly been documented. The accumulated experience in the field of injury control is, therefore, an additional important source for developing preventive strategies.

SOCIAL RISK: THE ROLE OF SOCIAL SUPPORTS

Statistics about death reveal little about life; but behind each death there is a life story. Police officers, social service and mental health workers are some of the witnesses to these stories. Their recorded accounts have provided the Study with a glimpse into the lives of some children. Violence, pain, or personal despair cannot be conveyed in simple numbers. Yet, the task of prevention requires systematic analysis of risk factors and means that reduce risk. Therefore, information about each child's personal and family circumstances was organized around the themes of social risk and availability of social services. The term "social risk" is used in this report to describe psychosocial circumstances which have become recognized by the professional community as problems demanding intervention.

In order to determine social risk, police, medical examiner and agency records were scanned for mention of any of over 20 individual and/or family problems. Out of this list the following problems were used as indicators of social risk: physical or developmental disability or chronic medical problem; previous or current legal involvement or pending court appearance; substance use (alcohol or drug); family violence, chaos or discord (threats, runaway episodes, etc.); history of child abuse/neglect; mental or behavioral disturbance including self-destructive behavior, suicide attempts, talk of suicide, etc. The same records also provided information on support services, such as counseling or foster care placement, which the child received in the past or at the time of injury.

The figures presented about these topics are limited in nature. No attempt was made to rate the severity of social risk, or to evaluate the quality or appropriateness of services provided. Rather, the information was viewed as a preliminary exploration of an area where much further work remains to be done.

Given these qualifications, the Study found that one-third of children who died of injuries (136 cases) had a range of personal and family problems that placed them at social risk (Table 13). High proportions of children with a social risk profile were identified among those who died of suicide (79%) and homicide (55%). Of victims of single motor vehicle crashes, 27% were considered at social risk.

Among those 136 children at social risk, 45, (or 33%) were receiving some kind of social or mental health service support at the time of death. The proportion of children at social risk was greatest among adolescents; yet adolescents at risk were less likely than young children to have been receiving services at the time of death.

TABLE 13 SOCIAL RISK* AMONG CHILD INJURY VICTIMS
MASSACHUSETTS 1985

Cause of Death	Number of Deaths	Child "at risk" % of total	Child receiving services ** % of "at risk" group
MVA (single vehicle)	96	27%	15%
MVA (multiple vehicle)	75	13%	30%
MVA (ped./bic.)	39	15%	33%
Drowning	25	16%	50%
Fire	18	17%	33%
Poison	10	70%	14%
Suicide	61	79%	33%
Homicide	44	55%	50%
Other Injuries	36	22%	50%
Total	404	34%	33%

* Social risk for all injury cases was defined as the presence of at least one of the following:

- physical or developmental disability or chronic medical problem
- current or previous legal involvement or pending court appearance
- history of substance use (alcohol or drug)
- family violence, chaos, discord
- history of child abuse or neglect
- mental or behavioral disturbance or self-destructive behavior.

** Services were defined as specialized health, mental health and/or social services being received by the child/family at the time of death (including long term care, substitute care, respite, counseling, alcohol treatment, etc.).

More than three-fourths of the adolescents identified as being at risk were not receiving any service at the time of death. These results suggest that the implementation of improved methods to get teens into appropriate services needs the attention of those who develop policy and programs.

SUMMARY

- The circumstances of injuries differ materially by age. Young children were injured most frequently in or around the home despite the presence of supervising adults. In contrast, adolescent injuries most often occurred away from formal settings or adult supervision and were associated with illegal or risk-taking behavior.

- More than half of the children who died of injuries in 1985 were either found dead or died within minutes of sustaining injury.

- Analysis of hospitalization and transfer practices (see Chapter VI) shows that in the majority of child injury cases, access to optimal medical care was provided.

- Cause-specific risks, i.e. situations of danger or hazards for which reasonable protective measures are available, were identified in 58% of all injury-related deaths. The highest proportion of cause-specific risks was among victims of motor vehicle-related accidents (72%). However, information on the use of protective measures (such as seat belts, smoke alarms, etc.) was not available in most records reviewed by the Study.

- Social risks, i.e. personal and family problems that require service response, were identified in 34% of all injury-related deaths. The highest proportions of children with social risk were known to be among victims of suicide (79%) and homicide (55%). Among children identified as being at social risk, one-third (33%) were known to be receiving some social or mental health services at the time of death.

VIOLENT AND SELF-INFLICTED INJURIES

INTRODUCTION

Over one quarter of all injury-related deaths of Massachusetts children in 1985 involved intentional injuries, namely suicide and homicide. Although these two causes of death differ greatly in many ways, the issue of intent links them. Both intentional and unintentional injuries are associated with an intricate interaction between the physical and social environments, substances and products that can cause injuries, and certain behaviors that increase vulnerability. The intent to kill either oneself or another person is an additional, and less well understood factor. Three major observations emerge from reviewing the data on intentional injuries.

First, attention must be paid to the means used to commit suicide or homicide. Research about firearm deaths has suggested that increases in suicide and homicide in the U.S. are closely related to the increase in the availability and possession of firearms by the public.(1) Access to guns has become a growing area of concern for those studying teen suicide in particular, because the greatest number of childhood firearm deaths are suicides.(2) The Child Death Study identified 22 suicides, eight homicides and two unintentional injury deaths that were caused by guns. Twenty-two of the 32 guns were known to be owned by someone in the victim's circle, such as the deceased, a relative or a friend. The ownership of the remaining guns was largely unknown. Among the firearm-related deaths with complete records, 54% of the guns were known to be handguns. Therefore, access to firearms, particularly in the child's home, is a major risk that needs to be addressed.

Second, the Study found that among children who died from intentional injuries, many had a history of individual and family problems (see Table 13). These problems may contain warning signs of suicide or indicators of potential violence against or from others. As no control group was available, it was not possible to compare the frequency of such problems among the general child population in Massachusetts with the victims of intentional injuries. However, the percent of victims with a history of particular problems was greater for intentional than for unintentional injury-related deaths in 1985.

In general, teen suicides had the highest percent of severe personal problems, such as legal trouble, mental health problems, and substance use. Homicide victims had the highest percent of family problems, such as family violence and child abuse.

TABLE 13 PERCENT OF PSYCHOSOCIAL PROBLEMS AMONG 1985 VICTIMS OF INTENTIONAL* AND UNINTENTIONAL** INJURIES

Problems	Intentional	Unintentional
Chaotic or violent family	32%	8%
Child ever lived/placed out of home	30%	7%
Alcohol or drug use by child	29%	6%
Child w/mental health problem	27%	9%
School problems	27%	8%
Child w/prior legal trouble	23%	5%
Peer problems	17%	1%
Prior child abuse	16%	6%
Parent w/mental health problem	12%	3%
Child in legal trouble at time of death	10%	3%

* N = 105
** N = 299

Last, underreporting is an area of particular concern in intentional injuries. Nationally, it is estimated that suicide is underreported by at least 25% to 40%.(3) The findings of the Child Death Study confirm that suicide and homicide are underreported as causes of death.

The Child Death Study counted 61 suicides in 1985 (ranging in age from 12 through 19 years old), of which only 50 were officially reported as such. The remaining 11 cases were certified as unintentional injuries, injuries undetermined whether intentionally or unintentionally inflicted, or unknown cause of death. Determination of intent often turns on the presence or absence of a suicide note. The Child Death Study learned of 13 notes left by teen suicide victims in 1985. However, one 1985 death certificate gave the cause of death as accidental hanging despite the presence of a particularly poignant suicide note.

Another disturbing undercount concerns the reporting of child homicides. Research using the FBI Uniform Crime Reporting System and national death certificate data indicates that child homicide is underreported by at least 20%.(4) As with suicide, there are social and legal issues which may influence the certification, as well as recording errors and incomplete recording. Several researchers consider that infant homicides, in particular, are underreported due to the difficulty of determining intent and unwillingness to consider murder as a possibility.(5) Eleven infant homicide victims were officially recorded (in Massachusetts vital statistics based on death certificates) for the entire five year period 1980-1984. Using a variety of sources such as police and hospital records, the Child Death Study counted 11 murder victims less than one year old in 1985 alone. This raises questions about the accuracy of vital statistics with respect to violent infant deaths in particular.

Twelve of the 44 deaths identified as homicides by the Child Death Study were officially reported as deaths due to non-intentional injuries, medical conditions or unknown causes. After reading police and public agency records, the Study found 11 of these 12 to be homicide by fatal child abuse. Child abuse is defined here as physical maltreatment by the child's caretaker/parent. Included among the 11 were three deaths caused by the abandonment of a viable newborn in places where the baby was extremely unlikely to be found. Also included were three children who were physically abused in infancy, causing severe medical problems which resulted in the children's deaths months or years later. In all, the Study identified 16 child abuse-related homicides. Only five of these were officially certified as homicides; none were reported as homicide due to child abuse.

There seems to be a pattern to the undercounting of suicides and homicides. Intentional injuries often appear on official records as deaths due to other causes (medical, accident, unknown) or, in the case of child abuse deaths, some are simply termed homicide.

No single source is responsible for the undercounting. The problem is partly due to the length and sensitivity of investigation inevitable with suicide and homicide deaths. In addition, the different types of information available to each source (such as police, social workers, medical examiners) are often not pulled together in a speedy fashion. The implications of the undercounting are serious. The greater the undercount, the more difficult it is to define, let alone address, the growing problems of suicide and homicide among our children. It is important to note that this underreporting does not imply that the cases were improperly or inadequately investigated, only that the vital statistics records are inaccurate. In fact, it is the completeness of police and agency investigations that allowed the Study to identify the deficiency in the vital statistics records.

SUICIDE

The victims

Teenage suicide has become an area of special concern nationwide. While rates among older people have declined, suicide rates for adolescents and young adults have been increasing since 1950.

According to vital statistics, a total of 177 Massachusetts children ages 10-19 took their own lives in the years 1980-1984, an average of 35.4 teen suicides per year. In 1985, the Child Death Study identified a total of 61 suicides of children, who ranged in age from 12-19. Fifty of these were recorded as suicides by vital statistics, so that by either count, the number of teen suicides has increased dramatically. Eight children were 12-14 years old, while 53 were between the ages of 15 and 19. Suicide accounted for 16% of the deaths in the 15-19 age group, and was the second leading cause of death after motor vehicle-related injuries.

Nationally and in Massachusetts, white male teens are at highest risk for suicide. Seventy percent of the 1985 suicide victims were white males and seven percent were Hispanic males. There were no black teen suicides in 1985.

The circumstances

Fifty-four percent of the victims were found dead, compared with 6% for all unintentional injury deaths. As shown in Table 14, guns were the leading suicide method, followed by hanging, car exhaust, and pills. In cases where the Study had information, 84% of the guns were owned by someone in the child's family, including the deceased. Fifty-nine percent were handguns.

TABLE 14 1985 MASSACHUSETTS TEEN SUICIDES - METHODS

Suicide Methods	Percent of Deaths
Firearms	36%
Hanging	28%
Car Exhaust	15%
Medications	15%
Other Methods	6%

Most of these children were living at home, and most committed suicide there. Seventy percent of the 1985 teen suicides took place in the child's own home, near home, or in the residence of another person such as a relative or friend. In 23 cases one or more adults were known to have been present in the house or area.

Nighttime, weekends and weekend nights were the most commonly chosen times for suicide. Overall, more than one in three suicides occurred between 11 p.m. and 6 a.m., and 41% on the weekend. Of the weekend suicides, 58% took place between 11 p.m. and 6 a.m. March was the month with the highest number of teen suicides, 14 or 23%.

Toxicology reports (38 reports available), together with police and medical examiner records, indicate that over one third of these teens used alcohol shortly before taking their lives.

Psychosocial problems

There are several common myths about adolescent suicide. One is that most teen suicide victims are over-achievers, children who feel under great pressure from themselves or their parents to earn good grades and get into good colleges. However, the Study found that 41% (25) of the 1985 teens who committed suicide were not in any educational setting. This is important to keep in mind, considering that the majority of proposed teen suicide prevention efforts have been linked with school programs.

Another myth is that most teens commit suicide 'out of the blue', with no history of problems. Extensive records from public agencies, police and medical examiners reveal that adolescents who committed suicide in 1985 had a range of severe problems involving mental health, school performance, relationships with peers and family, and criminal activity. Most of these 61 teenagers were not problem-free, college-bound or over-achievers.

Among the teens who committed suicide there was a consistently higher percentage of reported social problems in comparison with the child injury deaths as a whole. Some of the more striking contrasts are shown in Table 15.

TABLE 15 COMPARISON OF PSYCHOSOCIAL PROBLEMS BETWEEN 1985 VICTIMS OF SUICIDE AND ALL INJURY-RELATED DEATHS

Problems	Suicide	All Injury-Related
History of mental health problems	36%	13%
Alcohol or drug use	36%	12%
School problems	34%	13%
Prior legal trouble	30%	9%
Problems with peers	23%	5%
Due in court shortly	15%	5%

These problems may present themselves in a variety of ways, but are often ignored or denied by those who know the child, as the following case illustrates.

Phil had a gun collection, including several rifles mounted on his bedroom walls. His shelves and closet contained a wide array of hard liquor. Various beer cans were glued directly on the wallpaper. Before shooting himself with his pistol, he left three suicide notes. Family members say they were unaware that Phil drank or had so many guns.

Two of the most striking figures in the above table on social problems concern teen suicides who had prior problems with the law and those who were due to appear in court shortly. These figures indicate children in serious trouble who also have a great fear of the legal system, such as the boy who committed suicide rather than tell his parents that he had been caught shoplifting and was going to be arrested. The following example is a further illustration of these children's fear when confronted by the legal system with no support.

Craig had been arrested for his second drunk driving offense and was due in court the next day. He told family members he was going to commit suicide rather than spend the rest of his life in jail. Saying he needed cigarettes, he went to a deserted area and shot himself.

Clinical research indicates that a history of an unsuccessful attempt is a potent predictor of subsequent suicide.(6) Information about earlier suicide attempts or gestures was available in only half of the cases; among these, nearly two thirds were known to have made a prior attempt or gesture. Over half were known to have at least talked about committing suicide in the past. Prior talk about suicide ranged from joking to repeated declarations of intent.

Seth's friends said he almost never went out. He was depressed about a girl who would not go out with him. Although he often joked about suicide with friends, they never took him seriously. He told the girl he had dreamed about committing suicide over her. Shortly after this conversation, he shot himself at home using his father's revolver.

Several profiles emerge from reviewing the problem histories of these adolescents. The first profile is of the group with the most severe suicide risk, comprising the 51% of victims who were known to have talked about suicide or made an attempt or gesture in the past. Children in this group may or may not have had a recorded history of other problems as well. The second group is the 26% who were known to have had a history of mental health, legal, alcohol and/or drug problems, but whose records contained no mention of past suicide talk, gestures or attempts. Third are the 15% with no recorded problems. However, it is important to remember that the Child Death Study was not able to obtain complete information about all these children, especially given that suicide is a very sensitive family, social and religious issue. Therefore, all of the figures on problems given above are almost certainly undercounts.

Aside from the more extreme problems, it seems clear that adolescents view events such as the end of a relationship as major crises. They lack the perspective to see beyond the present, and are unable to believe that they will survive what seems like the end of the world. Many do reach out for help. Studies show that many suicide victims talked about and sought help for their suicidal feelings.(1) The Study had information about 13 youths who had talked to adults other than their parents about committing suicide, but help was not always forthcoming.

Greg had been talking about suicide to various school personnel for six months before he hung himself. No one referred him for counseling.

Social Risk

The most striking finding in regard to suicide was that 48 (79%) of the 1985 teen suicides were identified as being at social risk by the Study's definition. Two thirds of these children were not receiving any type of support or counseling services at the time of their death. Further, 56% of the children at social risk used guns or medications to commit suicide. We could find only one case where the medications used had been locked up. In no case were the medications used prescribed in amounts too small to be lethal. In no case were the guns and ammunition used locked up separately.

Suicide notes were the most heartbreaking reading in a study where all the records were painful. One note, paraphrased for confidentiality, reads:

"Dear Mom and Dad, I can't live in this shitty world anymore."

HOMICIDE

The victims

Nationally, reported homicide rates have been increasing over the last 60 years, particularly for children under age 14.(7) In Massachusetts there were 182 recorded homicide deaths of children ages 0-19 from 1980 through 1984. That is an average of 36.8 homicides per year among Massachusetts resident children. According to the Child Death Study, 1985 child homicides totaled 44. Among these 44, only 32 were classified as homicides by vital statistics. The FBI Uniform Crime Reporting System (FBI-UCR) also reported 32 child homicides for 1985.

Homicide figures for Massachusetts 1980-84 and U.S. in 1983 indicate that the majority of children murdered were 15-19 years old, and the next largest group were children under one year of age. The 44 child homicide victims in Massachusetts in 1985 follow the same pattern. Half were 15-19 years old and a quarter were under age one. The remaining quarter were primarily ages 1-4, so that children less than five years old accounted for 39% of the 1985 child homicide victims.

Over half of the 1985 child murder victims were black, an overwhelmingly disproportionate number. Black children comprised only six percent of the estimated 1985 child population in Massachusetts. In 1982, the FBI-UCR calculated that white persons living in the U.S. have a 1/240 chance of becoming a murder victim; persons of other races have a 1/47 chance.(8)

Females also had a higher risk of death from homicide than from other injury-related causes. While 45% of the 1985 murder victims were girls, only 27% of all the injury-related child deaths were female.

The death rate of low income murder victims was four times the rate for middle income children. It was not possible to compute a rate for the upper income group (as so few children in this group were murdered). More than a third of the homicide victims were receiving some type of Welfare assistance.

Among 1985 homicide victims, 41% were residents of the city of Boston, while only nine percent of the estimated Massachusetts child population in 1985 were Boston residents. No other cause of death concentrated so heavily in one area.

The circumstances

As with suicides, homicides occurred most frequently at night and on weekends. Forty-nine percent (of the cases where information was available) occurred between 11 p.m. and 6 a.m. and 47% happened on weekends.

Analysis of national FBI-UCR data indicates that the age patterns in child homicide are matched by patterns of method and circumstances. Younger victims are killed by means of bodily force associated with family violence. Adolescents are more often killed by guns or knives used in association with extrafamilial violence.(4) Table 16 shows the leading homicide methods.

TABLE 16 1985 MASSACHUSETTS CHILD HOMICIDES - METHODS

Homicide Methods	Percent of Deaths
Bodily force	37%
Guns	19%
Stabbing	14%
Arson	14%
All other methods	16%

Seven of the eight firearm murder victims were male. All other methods distributed more evenly between males and females. Forty-eight percent of the victims were found dead, in contrast with 6% for all unintentional injury-related child deaths.

The Child Death Study assigned up to two circumstances per case that could be considered the reason for the homicide, as shown in Table 17. The most frequently recorded reason was child abuse, followed by rape and lovers' quarrels.

TABLE 17 1985 MASSACHUSETTS CHILD HOMICIDES - FREQUENCY OF REASONS/CIRCUMSTANCES*

Circumstance	Frequency
Child abuse	16
Rape	6
Lovers' quarrel	6
Innocent bystander	5
Gang fight	4
Alleged criminal activity (i.e. drug dealing)	3
Other	6

*There was a total of 46 reasons given among 38 cases with one or more ascertainable circumstances.

The perpetrators

A perpetrator was identified in 35 of the 44 child homicides in 1985. Male perpetrators outnumbered females four to one. All seven victims of known female perpetrators were infants under one year old. In cases where the perpetrator's race was known, 88% were the same race as their victims.

Five out of six 1985 child homicides were committed by someone the child knew. Nine of the eleven victims under one year old were killed by a relative, usually the mother. Of the sixteen 15-19 year old victims whose murderers were identified, 11 were killed by an acquaintance. Again, FBI-UCR data confirm that this is a national pattern.(7)

The murderers not only knew their victims; often they had hurt or threatened them in the past. In one out of every two cases where the perpetrator was known to the victim, prior violence or threats of violence could be documented.

Child abuse

The Child Death Study identified 16 child abuse deaths in 1985, including three deaths of infants abandoned immediately after birth. None of these cases were officially certified or reported as child abuse deaths, although there is a special code for child abuse. Only five of these 16 child abuse deaths were officially reported as homicides. Four were certified as unintentional injuries, three were reported as "unknown" causes of death, and four cases, including three children who survived several months or years after being severely abused as infants, were certified as due to medical causes.

Wilfred was diagnosed with a severe skull injury at a few weeks old. The family had a child abuse history, and the baby's fracture was typical of child abuse injuries. Wilfred was paralyzed, blind, and deaf due to the skull fracture. After years of total dependency in foster homes and long term care facilities, Wilfred succumbed to pneumonia. On his death certificate, the underlying cause of death was given as severe mental retardation.

Victims of fatal child abuse were a distinct sub-group among the child homicides. Eighty-one percent of the child abuse deaths occurred to children under four years old. Two of the three older child abuse victims received their child abuse injuries when under one year old. Forty percent of the child abuse victims were black. Three out of four were killed by a parent. Often the event that led to the child's death was not the first instance of family violence.

Carmella's father was abused as a child. A woman he had lived with left him after he beat their baby. When he and his wife had a child, he begged her never to leave him alone with the baby, telling her about the past incident. One afternoon, the mother fed Carmella, put her in her playpen, and went next door to a neighbor's. When the baby began to cry, the father became frantic; he picked Carmella up, shook her, threw her on the floor, and then ran to the neighbor's with her body. Carmella was pronounced dead on arrival at the hospital.

Lee, a toddler, lived with his parents and a few of their friends and relatives. Several had criminal records, all were known to drink heavily and regularly. Various babysitters reported seeing the parents and others hit, drop, frighten, and otherwise maltreat Lee over a period of months, usually in response to his crying. Because Lee was slow at becoming toilet trained, he was often left screaming on his potty for hours. After Lee died, the autopsy revealed multiple recent and older injuries.

The above two vignettes illustrate a common pattern in child abuse homicide, the caretaker's impatience with the infant's or toddler's behavior. When the caretaker's expectations of an infant or toddler are unrealistic, the child's age-appropriate behavior is an ongoing irritant. The child abuse injuries seem to stem from physical responses or punishments which are not only inappropriate to the situation, but also inappropriate to a young child's fragility.(9)

Adolescent victims

For adolescent murder victims, the vulnerability is different, described as societal neglect by some researchers.(4) Some teenagers were facing violent situations and unstable living arrangements.

Zenobia ran away from a father who sexually abused her. After living with other relatives, she ran away again and made her living by prostitution. While temporarily in a group home, she said she wanted to live independently, without so many rules. She was beaten and murdered by a customer.

Ada and her boyfriend had lived together for some time. After breaking up with him over the phone, Ada asked a friend to stay with her. The boyfriend showed up to collect some belongings, got into an argument with Ada, and kicked the friend out of the apartment. Sounds of fighting followed by a long silence frightened the friend, who called the police. They found the door open and Ada's body inside.

Risk-taking behavior by teen homicide victims was an additional factor. Nine were in violation of the law, either because of alcohol use or involvement in criminal activity. Other forms of adolescent risk-taking, such as fights, challenges to fight, and personal or racial slurs caused other situations to escalate beyond control.

Psychosocial problems and social risk

As mentioned in the intentional injury introduction, the frequency of family problems was higher among child homicide victims than among children who died of unintentional injuries. For example, family violence and parental problems (with the law, mental health and alcohol or drug abuse) were markedly prevalent, as shown in Table 18.

When the Study's social risk index was applied to homicide, 55% of the child murder victims were identified as being at social risk. Half of these children were receiving some social support services at the time of death.

TABLE 18 COMPARISON OF PSYCHOSOCIAL PROBLEMS BETWEEN 1985 VICTIMS OF HOMICIDE AND ALL INJURY-RELATED DEATHS

Problems	Homicide	All Injury-Related
Chaotic or violent family	41%	14%
Child abuse	32%	9%
Substance abuse by parent	20%	6%
Parent w/mental health problems	14%	6%
Parent w/past legal trouble	11%	2%

UNINTENTIONAL INJURIES

MOTOR VEHICLE-RELATED DEATHS

Motor vehicle accidents (MVA) caused over half (210) of all injury deaths of Massachusetts children in 1985. Seventy-four percent of these children were boys. Table 19 shows that most MVA victims were adolescents (15-19 years old) driving or riding in motor vehicles. Among motor vehicle occupants and motorcycle riders, 82% were in this age group. In contrast, the majority of pedestrian and bicycle victims were children under age 15.

In Massachusetts, 44% of the 15-19 year olds who died in 1985 were killed in MVA's. The risk of death from an MVA is higher for this age group than for other ages. While teenagers comprise less than 10% of the U.S. population, they account for nearly 20% of motor vehicle deaths annually nationwide.(10)

TABLE 19 1985 MASSACHUSETTS MOTOR VEHICLE-RELATED CHILD DEATHS BY AGE OF VICTIM

Age Group	Motor Vehicle Occupant	Motorcycle/ Moped	Bi- cycle	Pedes- trian	Total Number
Under 1	1	---	---	---	1
1-4 yrs	8	---	2	6	16
5-9 yrs	3	---	4	6	13
10-14 yrs	12	5	6	6	29
15-19 yrs	111	24	3	6	144
All Ages	135	29	15	24	203 *

*Excludes seven cases in which the vehicle or circumstances were unknown or unclassifiable.

During 1985, Massachusetts law required proper use of a child safety seat or safety belt for all children under age five. Nine children under five years old also died due to motor vehicle-related crashes in 1985. The Study found that five of these nine victims were known to have been either improperly restrained or not restrained at all. Using protective devices such as a child safety seat, seatbelt or helmet can reduce the severity of injury in a crash. Unfortunately, little information was available concerning their use by the 1985 motor vehicle-related crash victims. Some researchers feel that more teenagers do buckle up in states where mandatory seatbelt laws exist, although they comply with such laws at lower rates than other age groups.(10)

Fatal occurrences are often responsible for more than a single death. The Study identified 193 motor vehicle-related crashes which caused the death of 210 children and 19 adults (age 20 and over). In addition, these crashes also injured 110 children, 70 adults, and six individuals whose age could not be ascertained. The total toll of these 193 crashes was 229 people killed and 186 injured.

Pedestrian deaths

The Study identified no clear patterns associated with pedestrian deaths aside from age. Visits to the site of injury to examine the physical characteristics of the locations were beyond the scope of this study. An investigation of the streets and intersections where pedestrians are struck could reveal patterns of pedestrian risk associated with the physical environment.

Non-pedestrian MVA's

In 1985, there were 169 motor vehicle-related crashes which did not involve pedstrians. The victims' vehicles included: cars (68%); mopeds or all-terrain vehicles (9%); bicycles (8%); motorcycles (7%); vans or trucks (6%); other or unknown vehicles (2%). Information on circumstances was obtained for most of the 144 crashes which took place in Massachusetts. About half of the cases with

complete information available involved a single vehicle, half involved a collision. Half the victims were operators, half passengers. (Among 15-19 year olds, 56% were operators, 44% passengers.)

Poor road, lighting and weather conditions did not appear to be a major factor in crashes, since these conditions were good in most cases, as indicated by Table 20. Most of the MVA's occurred in the summer, the season with the longest period of light and the best weather. Winter, the season with the shortest days, worst weather, and worst road conditions, was the season with the fewest MVA's. Many crashes took place on weekends (80 MVA's) and in the late night or early morning hours (one in three occurred between 11 p.m. and 6 a.m.). Over one quarter happened on Saturdays alone. This suggests that adolescent use of free time played a larger role in these events than the external conditions.

TABLE 20 1985 NON-PEDESTRIAN MVA'S - CONDITIONS AT THE TIME OF CRASH

Road Conditions	
Defect-7%	No Defect-93%
Light Conditions	
Dawn/Dusk or Unlighted Road-15%	Daylight or Lighted Road-85%
Weather Conditions	
Rain/Fog/Snow-16%	Clear/Cloudy-84%
Road Surface	
Wet/Snowy/Icy-23%	Dry-77%

Mopeds, dirt bikes, all-terrain vehicles

Sixteen children died in MVA's involving mopeds, dirt bikes or all-terrain vehicles (ATV's). The laws concerning these vehicles regulate licensing, registration, age of operator, helmet use, and where such vehicles may be used. The regulations differ for mopeds and ATV's. Apparently, they are not widely known, followed, or enforced. Most of the cases studied involved mopeds and ATV's that were unregistered, used without a license, or used in areas that are legally off limits. Recently, some of these vehicles are becoming recognized as dangerous and inappropriate for children and young teens.(11)

Adam received a dirt bike for his birthday. He invited his friend Ben for a ride on a clear summer morning a few days later. Adam wore a helmet, Ben did not. The dirt bike was unregistered. Adam tried to make a right turn onto another street, speeding up to get ahead of a car going straight through the intersection. He lost control, and skidded into the car. Both youths were thrown from the bike. Ben was run over and died almost instantly. Adam was injured and hospitalized. He was also charged with vehicular homicide and numerous other motor vehicle violations. Alcohol was not involved.

Legal violations and risk-taking behavior

Half of the 1985 MVA victims were in violation of the law in some way, including under-age drinking. The Study found that the majority of MVA's were associated with legal violations and/or risk-taking behavior by the operator of a vehicle involved in a crash. Among operators of vehicles in which a child died, 60% were in violation of the law. Table 21 shows the combinations of violations.

TABLE 21 1985 MVA'S - LEGAL VIOLATIONS BY OPERATOR OF VEHICLE IN WHICH A CHILD DIED

Legal Violations by Operator	Number of Cases
Speeding (no other violation)	21
License problem (suspended/revoked/no license)	14
Drinking (no other violation)	12
Speeding and drinking	26
Speeding and license problem	6
Speeding and drugs	1
Drinking and drugs	1
Speeding, drinking and drugs	2
Speeding, drinking and license problem	2
Drinking, drugs and license problem	1
Speeding, drinking, drugs and license problem	1
Other violation (i.e. operating to endanger)	15
Total Number of Operators in Violation	102 *

*This figure does not represent citations made by police. It is based on information abstracted from various records, including those of police and Registry of Motor Vehicles.

Drinking and driving are known to be a deadly combination. The Study obtained information on alcohol use in over 80% of the 210 1985 MVA deaths. Of these, one in three children had been drinking prior to the crash. This

ratio is the same for victims who were operating a vehicle and for those who were passengers. Nearly half of the 15-19 year olds about whom the information was available had been drinking.

Clark got bored at a teen party late one Saturday night. Taking a few beers and a girlfriend, he got in his car and drove around aimlessly for a while. His friend wanted to return to the party, so Clark made a U-turn and went back at high speed. They struck a car turning into a driveway, critically injuring all four occupants. The girlfriend died in the hospital two days later. Clark was charged with vehicular homicide and driving under the influence. He had been charged with driving under the influence several weeks earlier, but the case had not yet come to trial. Of all the victims, he was the least injured.

Contrary to what might be expected, drinking was not the most frequently mentioned legal violation by the operator of a vehicle in which a child died. In cases with full information, less than 40% of the drivers were known to have been drinking, while 55% were known to have been speeding. One out of every five operators was driving with either no license or a suspended license. Operating to endanger was also a frequent citation. Drinking is clearly not the only behavior that leads to death on the road. Some MVA's were caused by risk-taking behavior that became deadly simply because a potentially deadly weapon, a car, was involved.

On a sunny afternoon in late spring, Doug was playing 'chicken' with a few friends. This common teenage game became a tragedy, as these youths were playing chicken in two cars. No one was wearing a seat belt. There was no evidence of alcohol or drug use by the drivers or their passengers. Neither driver was speeding. Both had valid licenses. Doug died within minutes of the head on crash; his passenger lived for a few days, in a coma. The driver of the other car had minor injuries.

Legal violations were also associated with the motor vehicle operators who struck a victim's vehicle or a pedestrian. In the 1985 collisions, the driver of the second vehicle was in violation of the law in 32% of the cases with complete documentation. Half of the drivers who struck and killed pedestrians were in violation of the law, most for driving to endanger.

In total, the Study found that legal violations such as speeding and drinking were involved in 72% of the 1985 motor vehicle-related deaths among Massachusetts children. However, we believe that this percent would be even higher if more complete information were available. When a driver is killed in a crash, there is, of course, no legal charge made against him or her. In

records without a thorough narrative, this meant that there was no way to tell if the driver was in violation of the law in the crash. Information concerning a driver's prior violations was missing in most cases. Police and medical personnel are increasingly sensitive to the presence of alcohol, but accurate test results can only be obtained shortly after the crash. Although awareness of the dangers of drinking and driving is growing, toxicology reports were more sparse than expected. Despite these gaps in information, the prevalence of legal violations associated with MVA-related child deaths is a particularly striking finding.

Preventive measures intended to reduce the risks associated with motor vehicles do exist. These include child safety seats, seatbelts, airbags, and education about the effects of alcohol, as well as strict curfew laws for adolescent drivers. Beyond these approaches, it must be recognized that although speeding and drunk driving, for example, are illegal, they have become accepted as normal behavior by many teenagers and adults. Such dangerous attitudes and social norms must change. Stricter enforcement of existing laws involving speed limits, drinking, and reckless driving could be an effective start.

Social risk

Twenty percent of the 210 child motor vehicle-related crash victims were identified as being at social risk. However, when social risk factors were analyzed separately for victims of different types of crashes, it was found that those killed in MVA's where a single vehicle was involved were more likely to be at social risk than victims of other crashes (27% of single vehicle victims versus 14% of all other motor vehicle-related crash victims). This area may require further exploration because other research has suggested that some single motor vehicle crashes (i.e. a car goes off the road and hits a tree, with no apparent cause) may be suicidal in nature.

DROWNING

Among non-intentional injuries, drowning is the second leading cause of death to children. Twenty-five children drowned in Massachusetts in 1985. People drown at all ages, but research indicates that children one to four years old account for a disproportionate percentage of drowning deaths.[12] In 1985, over a quarter of the children who drowned in Massachusetts were ages one to four, although less than one tenth of the total 1985 Massachusetts child deaths were in this age group. Of the other 18 drowning victims, seven were 15-19 years old, five were 10-14, five were 5-9, and one child was under a year old.

Circumstances

Drowning deaths peak in the summer months. However, drownings do occur in other seasons. In 1985, 3 children drowned while walking on thin ice. Several young children fell into private swimming pools that were not completely covered or not thoroughly drained for the off-season.

The Study found that the victim's age was associated with the body of water where a child drowned as well as the child's activity at the time of drowning. Table 22 shows the bodies of water in which all 25 1985 drowning victims died. Table 23 shows what the children were doing at the time of injury.

TABLE 22 BODY OF WATER IN WHICH CHILDREN DROWNED

Body of Water	Number of Drownings
River/ocean/lake/pond	13
Swimming Pool	7
Reservoir/quarry	3
Bathtub	1
Unknown	1
Total	25

TABLE 23 CHILD'S ACTIVITY AT TIME OF DROWNING INJURY

Child's Activity	Number of Drownings
Fell in water	9
Swimming	8
Walking on ice	3
Boating	1
Bathing	1
Unknown	3
Total	25

In 1985, all eight drowning victims under age five drowned in bodies of water near their own or another's home. Five of these young children drowned in private swimming pools. The Study found that most younger children drowned after falling in the water while wandering or playing near the home, although adults were present in the vicinity. In several cases, the children fell into pools in areas which had fencing around the property but not around the pool itself.

Eva, a toddler, woke up early one morning. No one else was up, so she wandered around the house to the back door. She managed to open it and get into the family's fenced back yard. The swimming pool, in the center of the yard, had a cover, but it had slipped a few feet out of place. She was found in the pool some time later. The family called EMS and tried to administer first aid. Eva was pronounced dead at the scene.

Most of the teenagers and older children who drowned in 1985 were 'swimming' with friends, although many did not know how to swim. Only one adolescent died in a swimming pool, but in dangerous circumstances, as he and his friends had been drinking heavily and entered the pool when swimming was prohibited. Several adolescents chose to swim in bodies of water known to be hazardous, as the following example illustrates.

Fred went swimming with several friends on a hot summer day. The canal they went to had been the site of many serious accidents. There were signs posted, warning that the canal was dangerous and the area was private property. The signs had to be replaced frequently, as people tore them down. Despite the danger and warnings, the canal remained a popular swimming place. Fred and his friends entered the area, and although he was apparently unable to swim, they went quite far out. He began to struggle, and went under. His friends could not find him. Rescue workers found the body after a day of searching.

Hazards

The Study identified 11 of the 25 1985 drownings as occurring in hazardous circumstances. For younger children, these circumstances included the presence of any body of water near their home. Drowning hazards for adolescents and older children included risk-taking behavior that led to swimming in dangerous areas such as quarries, swimming while drunk, and misjudging their ability to swim.

Preventive measures that are currently known include physical barriers and warnings. Evidence is inconclusive as to whether swimming ability reduces or increases the chance of drowning. Some researchers feel that overconfidence about swimming ability can lead to risk-taking.(13)

Although preventive measures sometimes fail, physical barriers are likely to be effective with young children. Adolescents, on the other hand, can deliberately circumvent barriers. In 1985, several older children got around or over barriers in order to go swimming, although many did not know how to swim. Unfortunately, complete information about preventive measures was not always available to the Study.

Since drowning risk among children is polarized by age, preventive efforts must be age-targeted. While we cannot fence the ocean, secure fencing around pools and swimming education that deals specifically with risk-taking could be effective measures.

FIRES

The U.S. fire death rate and the incidence of fires in the United States are among the highest in industrialized nations.(14) Annually, only 25% of U.S. fires are residential, yet residential fires are responsible for 76% of fire deaths.(14) In Massachusetts in 1980-1984, an average of 24 children per year died as a result of fires that authorities considered were not purposely set; the Study identified 18 fire-related child deaths in 1985.

The non-arson fires

Research indicates that children under age ten and adults over 65 years old are at greatest risk in residential fires, probably because these groups may need the assistance of others for mobility or direction in order to escape

from an emergency situation.[14] The Study findings confirm this pattern for young children. In Massachusetts in 1985, there were 11 fires in which 18 children, 13 of them under ten years old, died. Four of the other five child fire victims were 10-14 years old, one was 15-19 years old. No adults died as a result of these fires, although one or more adults (a parent or other relative) was known to be present in seven of the 11 fire events. In several fires parents were very quick to wake their children. Narrative in various records indicated that when parents kept children in front of them on the way out, both children and adults escaped. Children who were following behind their parents often panicked in the confusion, and ran and hid, to be overcome by smoke.

The Study found that a strikingly high proportion of the 18 child fire victims were minorities and poor. Two-thirds were black or Hispanic. Half were receiving some form of assistance from Welfare.

Other studies have found that most housefire deaths are due to fires occurring from December through March, the coldest and darkest months.[15] Seven of the 1985 Massachusetts fires took place during these months. Six of the 11 started between midnight and 6 a.m. Sixteen children were known to have been sleeping when the fire started.

Product involvement plays a significant role in fires. Heaters, cooking equipment or other products were the ignition sources in eight of the 11 fire events. In many cases, products were misused. In several cases, space heaters were placed too close to flammable curtains or furniture. Five children died in a home with no heat except for the space heater which caused the fatal fire. Cigarettes carelessly disposed, by being dropped on a livingroom couch or chair, were responsible for three fires.

Arson

In addition to the fires described above, there were three purposely set fires which killed six children. Since an arson death is considered a homicide, the six child arson victims are included among the homicide victims in this report. A brief discussion of the arson fires is appropriate here in light of the similarities and differences between unintentional and intentional fire deaths.

Unlike the unintentional fires described above, these arson fires killed adults as well as children. Arson proved fatal for more older children than unintentional fires: while half of the six victims were under 10, the other half were 15-19 years old. All six arson victims were black.

Arson fires were set during the night when the victims were asleep. All were either found dead or died within minutes of being found.

Risk and prevention

There is a great deal of information relevant to fire risk and prevention that was unobtainable from any record. Information about the existence or nature of fire code violations or combustible materials was available in very few cases. In seven cases, there was no information available concerning the presence of smoke detectors or fire extinguishers. In three cases, there were

either no smoke detectors or the detectors were improperly used or maintained. More information about the presence of cause agents and preventive devices is needed in order to assess their relative danger and efficacy.

There are no uniform statewide laws requiring smoke detectors in all types of residences. Enforcement of existing laws is erratic. The arson fires demonstrate the importance of functioning smoke detectors. Two set fires that each killed two people took place in multi-family buildings with smoke detectors; over 20 people escaped uninjured. A set fire in a single-family dwelling without smoke detectors killed five people; only one person escaped.

In 1985, residential fires which killed children only injured adults. The exceptions were the arson cases, perhaps because the progress and intensity of a set fire may differ from an unintentionally started fire. Young children's panic behavior is to be expected, and they need assistance in escaping as well as warning of danger. Mandated burn prevention education in schools could be enforced and expanded to include escape procedures.

POISONING

Unintentional poisoning

Fortunately, poisoning deaths are relatively rare events. Research indicates that over 1,000 poisoning incidents are reported to poison control centers for every one poisoning fatal to a child under age five. Children under five years old constitute only 1% of all fatal poisonings. Poisoning deaths among children in this age group declined dramatically following 1973 legislation which required childproof packaging for drugs and medications.(15) Now, although most non-fatal poison injuries occur among younger children, most poison deaths occur among teenagers.(16) Study findings confirm this pattern.

In 1985, while two of ten poisoning victims were one year old, two were 10-14 and six were 15-19. Poisons are usually self-administered. In the case of young children, it is assumed that the child mistook the poison for another substance--something desirable. Another way young children become victims is simply by putting anything they find in their mouths. However, most poison deaths occur among adolescents, who are generally aware of the nature of the substances they take. The substances taken by the 1985 victims reflect this pattern, and include illegal drugs (five cases), prescribed medications (two cases), household products (two cases), and one case in which the substance could not be ascertained. For the most part, teenagers took illegal or prescription drugs. Four victims, all teenagers, combined medications or illegal drugs with alcohol. From various records, we know that most adolescent victims took illegal and other substances in order to get high. Cocaine was the most commonly-taken illegal drug, followed by heroin. The cocaine-related deaths were characterized by sudden collapse, similar to several very famous cases which have recently come to light.

Ascertaining intent

In 1985, there were a total of 19 poisoning deaths among children and youth. Nine were suicides. Of the ten discussed above, six were clearly unintentional. In the other four cases, there was insufficient evidence to determine intent. When the substance is a medication, it is especially

difficult to determine whether the overdose was unintentional or purposeful. Although suicide is discussed under a separate heading, some comparisons are made here in order to present the similarities and differences among intentional and unintentional poisoning deaths.

Risk

Among the ten poisoning victims who were not classified as suicide, seven were identified as having had personal or family problems which placed them at social risk. Problems included chronic illness, history of substance use and mental health problems. Only one of the seven was receiving counseling at the time of injury.

In addition to the high incidence of a problematic social background, seven of the ten victims were able to obtain illegal drugs or prescribed medications in dangerous quantities. None of the prescribed drugs were locked up or prescribed in limited amounts. The combination of social risk with ready access to poisons characterizes the victims of unintentional poisoning.

The nine children who committed suicide by using poison had a demographic profile much like the ten poison victims described above. They were also similar in terms of risk. Seven of the nine were identified as children at social risk, and eight readily obtained the substance taken.

The major difference between the victims of intentional and unintentional poisoning was the substances used. All nine suicide victims took large quantities of medications prescribed for themselves or their parents, and only one teen poisoning suicide is known to have combined medications and alcohol. In contrast, the other ten poisoning victims took more illegal drugs than medications, and more were drinking. Use of cocaine, heroin and alcohol is often seen as recreational by teenagers. Among other risk-taking activities, many teenagers do experiment with alcohol and illegal drugs.

Though exposed to anti-drug and anti-drinking information in school and on television, teens are often ignorant of the dangers of combining drugs and alcohol. Also, past anti-substance campaigns which conveyed emotional messages rather than facts may have left adolescents skeptical and uninformed about the dangers of drugs and alcohol. Unfortunately, preventing teen access to illegal drugs is a very difficult police task. Some poisoning deaths, unintentional as well as intentional, could be avoided if medications were prescribed in quantities that are not lethal.

OTHER UNINTENTIONAL INJURIES

In 1985, 36 Massachusetts children died of asphyxiation, falls and other injuries, detailed in Table 24. As in prior years, the victims were predominantly adolescents 15-19 years old (16 cases) or very young children under five (12 cases).

TABLE 24 1985 OTHER UNINTENTIONAL INJURIES - TYPE OF INJURY

Type of Injury	Number of Deaths
Asphyxiation	11
Falls	7
Other Transport (i.e.Train, Animal)	5
Unintentional Firearm	2
Electrocution	2
Crushed by Machinery	2
Sports Injury	1
Scald	1
Hypothermia	1
Unintentional Stabbing	1
Falling Tree Limb	1
Mauled by Animal	1
Unknown	1
Total	36

Asphyxiation

Young children are particularly susceptible to situations that may cause asphyxiation, because although most of a young child's body is small or easily compressed, the head has the largest diameter and cannot be compressed. Therefore, a child can wriggle his or her body through very small spaces and be caught or suspended by the head, causing asphyxiation. While manufactured cribs are now standardized to prevent asphyxiation injuries, replacing the original mattress, making other modifications, or using older cribs creates a potential hazard.(17) Also, infants and young children are unable to move away from or remove objects that obstruct breathing. The various types of objects which asphyxiated 11 children in 1985 included ropes or cords (three cases), plastic bags (two cases), cribs or beds (two cases), food (one case), and other objects (four cases). Five of the objects were misused, including one case of an unattended toddler slipping through a hole in a home-made crib. Other babies asphyxiated by slipping through other small spaces, such as the bars of a walker. The two of the three older asphyxiation victims were playing with ropes or other objects around their necks when the injury took place.

Falls

Studies have shown that falls are the most common cause of non-fatal injury at all ages in this country, but are not a leading cause of death.(15) In Massachusetts, falls are the leading cause of hospitalization due to injury among males and females ages 0-19.(18) In contrast, only seven Massachusetts children died as a result of falls in 1985; all were male. The circumstances of these fatal falls varied from case to case. One young child fell from an upper-story window. Several teens fell from walls or buildings which they were climbing for fun or after drinking.

Other injuries

There were 18 child deaths by other unintentional injuries in 1985. These are listed in Table 24, and are rare occurrences for the most part. Some, such as the unintentional firearm deaths, fluctuate in number from year to year.

These injuries were more common among older children, particularly boys 15-19 years old. The circumstances varied. Some occurred during supervised activities such as employment. Others were associated with risk-taking behavior by adolescents, such as lying on train tracks or climbing high voltage electricity poles.

SUMMARY

Suicide

- Official statistics for 1985 undercounted teen suicide by 22%. Again, this is a problem with vital statistics rather than an improper investigation, as described earlier.

- Among suicide victims, 77% were males. White males accounted for 70% of suicide deaths.

- Firearms, the leading suicide method, were used in 36% of suicide deaths. The majority of guns (84%) were owned by someone in the child's family.

- Among the 1985 teen suicides, 79% were identified as being at social risk. Of those at social risk, one third were receiving some support or counseling at the time of death. Among children with social risks, 56% used guns or medications to commit suicide. In no case were the medications used prescribed in non-lethal doses. In no case were the guns and ammunition locked up separately.

CONTINUED

Homicide

- Official statistics in 1985 undercounted child homicide by 38%. (See earlier notes regarding discrepancies.)

- More than a third of child homicide deaths (16 out of 44) resulted from child abuse or infant abandonment. None of these cases were officially reported as child abuse deaths on death certificates. Investigations had to have been done with recording by police and/or social service agencies in order for the Study to have identified them.

- The demographic profile of child homicide victims reveals a unique pattern of vulnerability: higher proportions were poor, female, black, very young and Boston residents than among other children studied.

- Five out of six victims were murdered by someone they knew, relatives or acquaintances. Often the perpetrators had threatened or hurt their victims in the past. Bodily force was the leading method of child homicide, followed by guns.

- 55% of child homicide victims were at social risk. Of these, half were receiving personal or family support or counseling at the time of death.

Motor Vehicle-Related Deaths

- Over half of all 1985 child injury deaths in Massachusetts were motor vehicle-related (including pedestrians and bicyclists). Seventy-four percent of these children were male. Motor vehicle accidents were the leading cause of death among 15-19 year olds, accounting for 44% of all deaths in this age group.

- The toll of the motor vehicle crashes which killed 210 children was 229 people killed and 186 injured.

CONTINUED

- Motor vehicle-related deaths occurred in all economic groups and in all parts of the state.

- Legal violations were involved in 72% of all motor vehicle-related deaths. 60% of operators of vehicles in which a child died, 32% of the drivers of second vehicles in collisions, and half of MVA victims were in violation of the law. Violations included speeding, drinking, license problems, and reckless driving.

- Since many crashes took place on weekends and late at night, adolescent use of free time seems to play a large role in these events. Road, lighting and weather conditions were good in most cases.

Other Injuries

- 25 children drowned in Massachusetts in 1985. Young children drowned most often in bodies of water near a home, while teenage victims often drowned while swimming with friends in dangerous locations. Several young children fell into pools that had fences around the area, not the pool itself.

- Fires claimed the lives of 18 children in 1985. Three quarters were under 10 years old; half were on public assistance; two thirds were black or Hispanic. In several cases there were no functioning smoke detectors. In two fires in which children died, functioning smoke detectors saved over 20 people.

- In 1985 there were a total of 19 poisoning deaths. Nine were suicides, six were unintentional, and in four cases intent could not be determined. Poisonings were frequently associated with social risks.

- Other causes of unintentional injury such as suffocation and falls caused 36 child deaths in 1985.

CHAPTER V MEDICAL CONDITIONS

Medical conditions are defined as illnesses and disabilities not caused by traumatic events. Medical conditions include infectious diseases, cancer, congenital anomalies and conditions specific to the neonatal period, genetic disorders, degenerative neuromuscular processes, metabolic and nutritional disorders, and Sudden Infant Death Syndrome (SIDS). In this chapter, medical conditions will be discussed in two large groups: those resulting in the deaths of neonates and those related to the deaths of children from the postneonatal period through adolescence.

NEONATAL DEATHS

Infant mortality is one of the most sensitive measures of the health status of a community. Compared to the other states, Massachusetts has one of the lower infant mortality rates, ranking 7th in 1984. Among the large industrial states, Massachusetts has the lowest infant mortality rate. However, this overall favorable comparison obscures the fact that there are populations and areas of the state with unacceptably high infant mortality rates. The analysis of overall patterns of infant and neonatal mortality, factors related to this important health outcome, and proposals for improving the health of mothers and infants have been the subject of several recent reports. (1)(2)(3)(4)

The purpose of this section is to review existing data obtained primarily from official vital statistics to describe the patterns of neonatal mortality in Massachusetts. Data for 1985 were supplemented with additional research to correct minor misclassifications of ethnic origin in the official statistics and to identify the socioeconomic status of each neonatal death.

Definitions

The infant mortality rate (IMR) is the number of deaths in the first year of life per 1000 live births. Infant mortality is made up of two components: the neonatal mortality rate (NMR) is the number of deaths in the first 27 days of life per 1000 live births and the postneonatal mortality rate (PNMR) is the number of deaths occurring between 28 days and the first birthday per 1000 live births.

A low birthweight (LBW) infant is defined as one born weighing less than 2500gm. A very low birthweight (VLBW) infant weighs less than 1500gm. at birth. The rates of LBW and VLBW are usually presented as percents of live births.

The birthweight specific neonatal mortality rate is defined as the number of neonatal deaths for a group of newborns within a specific birthweight group, eg. 1000-1499gm., per 1000 infants born at that weight.

Neonatal deaths in 1985

In 1985, 750 Massachusetts infants died in the first year of life. More than two-thirds of these infant deaths, 542 (72.3%), occurred in the first month of life -- the neonatal period. (These numbers vary slightly from the official Massachusetts vital statistics for 1985 because additional research carried out during this Study was used to correct minor misclassifications in the official data.)

Neonatal mortality generally reflects the health of mothers during pregnancy and the ability of the perinatal health care system to provide adequate care to low birthweight and sick premature neonates. Of 542 neonatal deaths in 1985, 533 (98.3%) were disease-related. Two-thirds (66.6%) of these neonatal deaths were related to perinatal conditions, including those related to the mother's health, complications of the delivery, immaturity and low birthweight, and other conditions unique to the perinatal period. Birth defects (congenital anomalies) of the infant accounted for 147 neonatal deaths (27.6%), SIDS for five (0.9%), other medical conditions for 21 (3.9%), and unknown causes for five (0.9%).

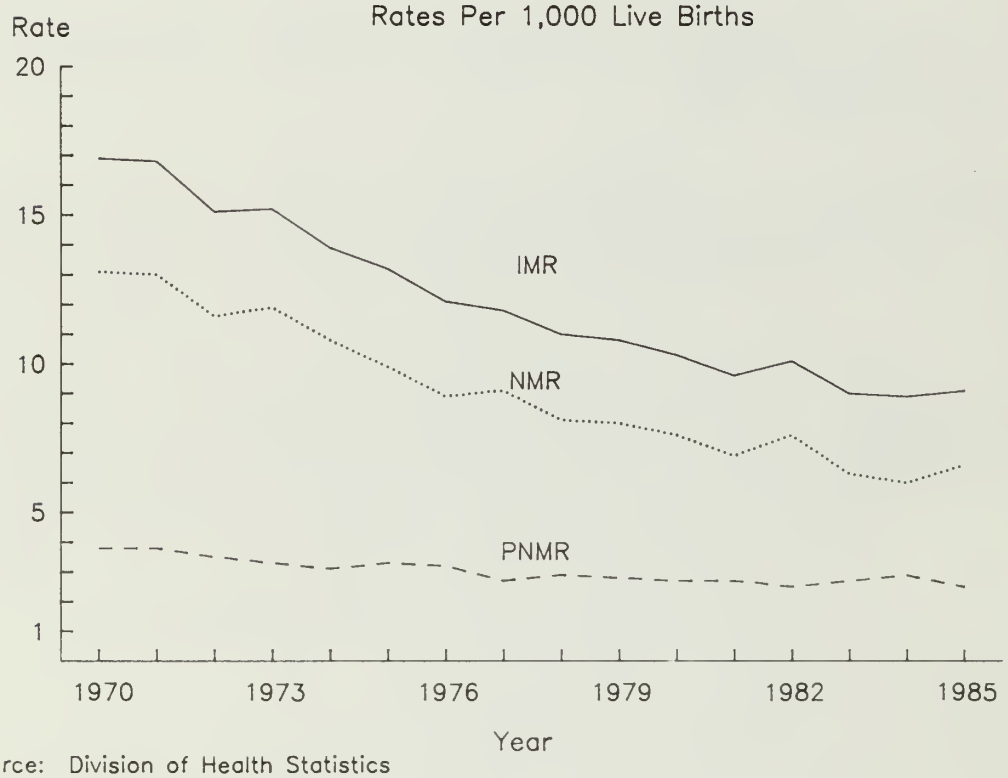
The racial and ethnic distribution of these neonatal deaths differs somewhat from the official Massachusetts vital statistics, again, because additional information was obtained by the investigators; 405 (76.0%) neonatal deaths were white, 87 (16.3%) were black, 35 (6.6%) were Hispanic, and six (1.1%) were other groups. These data indicate that blacks and Hispanics contribute disproportionately to the neonatal death rate. The analysis of death rates by income group, described in Chapter III of this report, indicates that poor infants also contribute disproportionately to the neonatal death rate. Data presented in Tables 9 and 10 show that the disparities in death rates between children from low income and high income areas were particularly high among infants, and among those who died of perinatal conditions. The death rate from perinatal conditions in the low income group was more than four times the rate of the high income group. This finding is specifically relevant for neonates because the majority of deaths from perinatal conditions (94%) occurred during the first month of life.

Trends in mortality rates

Trends in neonatal, postneonatal, and infant mortality rates in Massachusetts over the last 16 years are shown in Chart F. These rates are derived from the Massachusetts vital statistics in order to assure consistency of collection and classification across this time period.

Infant mortality declined continuously over this time period until 1982 when it rose dramatically; since 1983 the IMR has remained between 8.9 and 9.1. The fall in IMR paralleled the decline in neonatal mortality resulting from dramatic improvements in the survival of low birthweight infants due to innovations in the management of high risk deliveries and neonatal intensive care interventions. The continuous decline in NMR seen in the early part of this time period, however, has also been reversed, and neonatal mortality rates have risen in specific low income and minority groups, particularly those living in the larger urban centers.

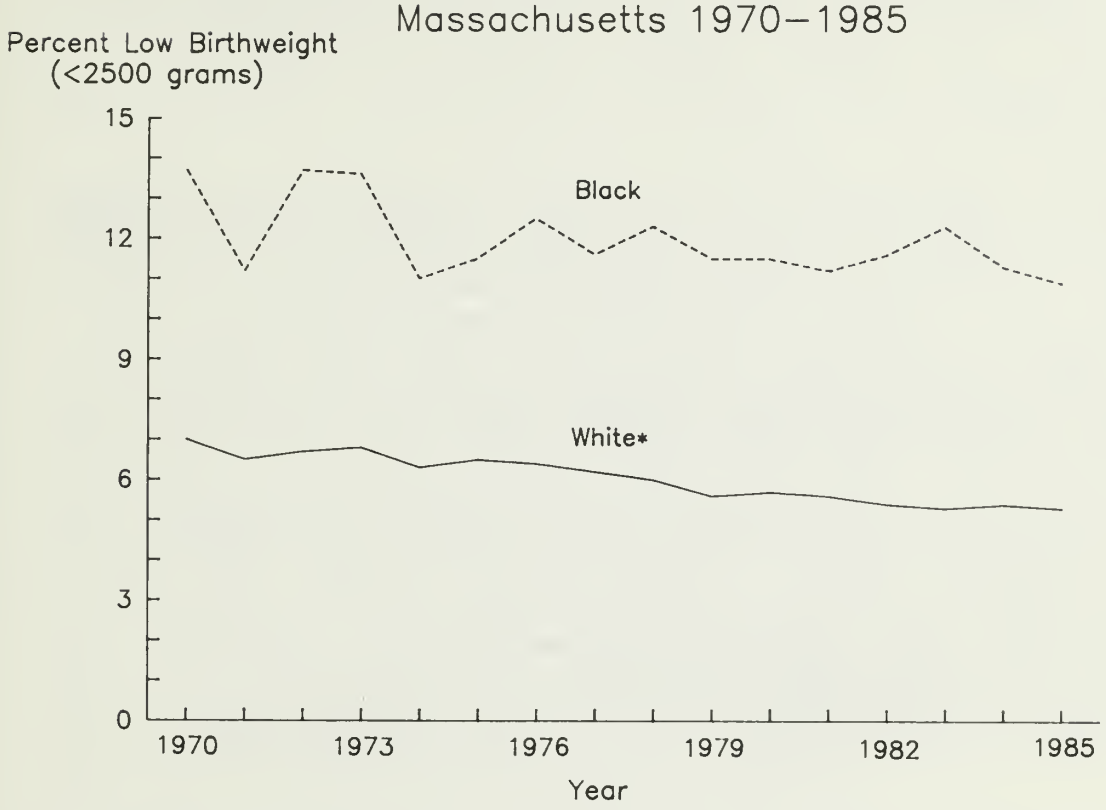
Chart F.
Infant, Neonatal & Postneonatal Mortality Rates
Massachusetts 1970–1985



Data Source: Division of Health Statistics and Research, DPH

The proportion of infants born weighing less than 2500 grams, known as low birthweight, has changed relatively little over this time period (Chart G). Blacks continue to deliver low birthweight babies at approximately twice the rate of whites, accounting for much of the excess infant mortality among black babies.

Chart G.
Proportion of Low Birthweight Births by Race
Massachusetts 1970–1985



Data Source: Division of Health Statistics and Research, DPH

* White includes Hispanics

Birthweight specific mortality rates measure the ability of the health care system to provide care for low birthweight and sick infants. While birthweight specific neonatal mortality rates declined dramatically over the early part of this period, these rates have failed to decline further and have even risen somewhat for the larger neonates. Future progress in reducing neonatal mortality requires consistent efforts to reduce the rate of low birthweight.

MEDICAL CONDITIONS IN CHILDREN BEYOND THE NEONATAL PERIOD

A medical record review was performed for all children aged one month through 19 years who died from nontraumatic causes during 1985, and for whom medical records could be located.

The purpose of the medical record review was to acquire reliable medical and demographic information in an effort to identify potential opportunities for public initiatives to reduce childhood mortality from medical conditions. The review focused on defining patterns in the care of terminally ill children in the Commonwealth. No attempt was made to assess the medical management of individual children or to judge the quality of care provided in each case.

General findings

In 1985, 389 Massachusetts children aged one month through 19 years died from medical conditions, accounting for approximately half (49.2%) of all deaths in this age range. Therefore, despite the many recent gains in prevention and treatment, medical conditions still represent a major contributor to childhood mortality in Massachusetts.

Although medical conditions were responsible for a significant portion of deaths throughout childhood, there is considerable variation in the extent and nature of mortality from medical conditions within each age group. The death rate from medical conditions is highest in children under one year of age. The mortality rate falls somewhat in preschool children and then falls and stabilizes in school age children. It then rises in adolescents. In terms of the relative proportion of deaths due to medical conditions, the older the child the lower the proportion of deaths due to medical conditions, since the incidence of injury-related mortality rises as a child grows and develops.

When one reviews the entire 1985 mortality experience for all children aged one month through 19 years the leading cause of death from medical conditions was congenital anomalies, followed closely by Sudden Infant Death Syndrome (SIDS). Both these causes are heavily concentrated in the first year of life. After infancy (age one), the leading medical cause of death was cancer. Table 25 presents the age distribution of deaths from specific medical conditions for 1985. Medical conditions were coded by the Study's coders, using the International Classification of Diseases (ICD) coding schemes.

TABLE 25 1985 CHILD DEATHS FROM MEDICAL CONDITIONS BY AGE

Cause of Death	Total	Age				
		1 month to under 1	1-4	5-9	10-14	15-19
Congenital Anomaly	87	53	16	4	4	10
SIDS	79	76	3	0	0	0
Cancer	65	2	14	9	11	29
Dis. of Circulatory/ Blood Sys.	49	14	11	4	3	17
Dis. of Nervous Sys.	32	5	9	3	4	11
Perinatal Conditions	23	23	0	0	0	0
Infection	13	6	5	0	0	2
Other Medical	41	15	6	3	5	12
All Medical Conditions	389	194	64	23	27	81

Specific findings

Mortality from medical causes was examined in relation to a number of different variables. However, of central concern in identifying areas of possible prevention was defining the level of health-related risk of the child prior to the terminal illness, the nature of the terminal illness, and the response of the medical system to the child's need for specialized care. These issues can, in turn, be analyzed in association with other relevant factors such as payor status (type of medical payment coverage), income, age, and area of residence.

Underlying medical conditions

A major issue for examination was the extent to which children dying from medical conditions were healthy prior to their terminal hospitalization or whether they were suffering from significant chronic illness. This distinction is important in assessing and ultimately addressing the health needs of these children and the circumstances leading to their death.

Information regarding the existence of significant underlying illness in the reviewed records was available in 93.3% of all cases. For all deaths with medical causes, 71.5% suffered from significant medical illness prior to their terminal hospitalization. Of the 93.3% of cases that had sufficient information, 76.6% had documented underlying illness. Of these cases, 67.6% had documentation in the record that they had been receiving ongoing medical care for their illness prior to their terminal hospitalization.

As mentioned earlier, death from SIDS contributes significantly to the total number of deaths due to medical conditions. However, by definition, death from SIDS appears as a sudden, catastrophic event. Only 14.3% of SIDS cases were noted to have been suffering from significant underlying illness prior to the SIDS event. Therefore, it is also useful to examine the existence of underlying disease excluding SIDS cases.

Without SIDS cases, 84% of all cases, and 87.3% of all cases with available information, had documentation of a significant underlying illness prior to the terminal hospitalization. In 91% of these cases the documented underlying condition was related to the ultimate cause of death. The fact that most of these cases had underlying illness for longer than one month suggests that the vast majority of children who die from medical causes in the Commonwealth suffer from chronic conditions prior to their terminal hospitalization.

Payor status

The method of payment for medical and associated care remains a major issue for public policy debate and potential initiative in the Commonwealth. Therefore, the distribution of medical causes of death by payor status was examined in some detail. Information on payor status was available for 80% of hospital deaths. Among these cases with information available, the largest number of deaths was associated with medical coverage under the Medicaid program (40.8%). Coverage by Blue Cross/Blue Shield accounted for 24.3%,

commercial insurance plans accounted for 17.3% of deaths, while health maintenance organizations (HMO's) and other types of medical insurance were associated with another 11.6%. Self pay, or uninsured cases accounted for six percent of all medical deaths.

The relatively large proportion of Medicaid cases is far greater than one would predict based on the proportion of children in the Commonwealth who receive Medicaid benefits. The precise reasons for this observation are difficult to specify, although several explanations seem likely. First, the high proportion of Medicaid cases probably reflects the higher death rates experienced by children living in poverty. Second, chronically ill children, the majority of medical-related deaths, are more likely to be eligible for coverage by the Medicaid program.

The proportion of cases that had no insurance coverage was relatively low compared with estimates based upon the general population of all ages. Again, this may reflect the high coverage of the Medicaid program for poor and chronically ill children in the Commonwealth. Therefore, it was not surprising to find that uninsured status was more frequently associated with older children and adolescents.

Although the proportion of children without insurance was relatively small, one should not assume that the lack of medical insurance caused no hardship. Quite the contrary, 14 of the 17 children without insurance died after long illnesses and/or hospitalizations. That 14 such cases occurred in one year in the Commonwealth remains a disturbing finding and one worthy of considerable attention.

Income

Although payor status offers some insight into the influence of socioeconomic status on childhood mortality from medical conditions, family income is also an important factor for examination [5][6]. Payor status deals most directly with the possible existence of financial barriers to medical care, while family income is more likely to reflect the adequacy of the child's general social environment. Therefore, while payor status and family income are related, an independent analysis of an estimate of family income was performed.

As outlined in Chapter III, an estimate of family income was calculated based on the census tract of each child's residence. All cases were then allocated to three groups of ascending income. Table 26 presents the cause-specific mortality rates by income group for children over one month of age who died of medical conditions.

It can be seen in Table 26 that mortality from the following causes was elevated in the poorest group of children: anomalies, perinatal conditions, SIDS, infections, circulatory/blood diseases, and other medical conditions. The largest number of excess deaths in the poorest group of children was due to SIDS. It has been well documented that SIDS occurs more frequently in families of low socioeconomic status. In part this is related to the increased prevalence of high risk conditions associated with elevated rates of

low birthweight and prematurity in poor populations. However, the causes of major portions of this excess SIDS mortality remain unknown. It is difficult to assess the policy implications related to this elevated SIDS mortality in the poorest group of children.

Table 26 CAUSE-SPECIFIC DEATH RATES OF MEDICAL-RELATED DEATHS BY INCOME LEVEL CHILDREN AGED 1 MONTH - 19 YEARS, 1985*

	Low Income (group 1)		Middle Income (group 2)		High Income (group 3)	
Medical Condition	Rate per 100,000	N	Rate per 100,000	N	Rate per 100,000	N
Cancer	3.8	(10)	4.6	(37)	2.4	(14)
Congenital Anomaly	6.8	(18)	5.6	(45)	3.6	(21)
Perinatal Condition	3.8	(10)	1.2	(10)	0.5	(3)
SIDS	10.6	(28)	3.7	(30)	3.1	(18)
Infection	2.7	(7)	0.5	(4)	0.3	(2)
Dis. of Nervous System	0.8	(2)	1.4	(11)	2.2	(13)
Dis. of Circul/blood	6.1	(16)	2.2	(18)	2.0	(12)
Other Medical	5.3	(14)	2.4	(19)	0.9	(5)

* See Chapter III for descriptions of income groups.

The high relative mortality in the lowest income group (Group I) due to congenital anomalies warrants special attention. It is sometimes suggested that deaths from congenital anomalies do not merit close scrutiny in policy analyses because there are at present very few mechanisms to prevent such occurrences. However, the high relative mortality in Group I is of concern since serious congenital anomalies have not been reported to be more prevalent in poor populations in the United States. Therefore, if the prevalence of serious congenital anomalies is, in fact, not higher in Group I, but mortality from this cause is, it would appear that poor children with serious congenital anomalies in the Commonwealth are more likely to die than are similarly afflicted wealthier children.

Although infectious conditions did not account for a large portion of all medical deaths, there was a high relative mortality rate in the poorest group of children. These children were primarily on Medicaid, although one child was uninsured. Of 18 children whose death was classified as due to infectious disease or meningitis, 16 cases presented to the hospital in critical condition, requiring endotracheal intubation (insertion of a tube to the airway to allow for mechanical respiration) within three hours of presentation to the hospital. One third of these children had not had contact with medical personnel within one week prior to hospitalization. The likelihood of presenting to the hospital with severe illness without prior contact with medical personnel was disproportionately high for children in the low income group.

SUMMARY

Neonatal Deaths

- Neonatal mortality remains an important contributor to childhood mortality in the Commonwealth.

- The progress in newborn survival of the past decade has been primarily due to innovations in the management of high risk deliveries and critically ill infants. Access to these innovations is based on a strong regionalized system of tertiary care.

- To continue the Commonwealth's progress in reducing neonatal mortality efforts must be implemented to reduce rates of low birthweight.

- Disparities in neonatal mortality persist in the Commonwealth. Poor and minority communities suffer disproportionately from high rates of low birthweight and neonatal death.

Childhood Mortality

- Approximately half of all childhood deaths, ages 1 month through 19 years, are caused by medical conditions.

- Almost nine out of every ten children dying from medical conditions suffered from significant chronic illness prior to their terminal hospitalization.

- Death from medical conditions was disproportionately high for low income children and those on Medicaid.

- Although most children who died from medical conditions had insurance, 14 children who died after extended illness or hospitalization were without medical insurance.

- A significant portion of children dying from infectious diseases presented to a hospital in critical condition without having seen medical personnel within the preceding week.

CHAPTER VI THE RESPONSE OF THE MEDICAL CARE SYSTEM TO CRITICAL CHILDHOOD INJURY AND ILLNESS

Once a child falls critically ill or sustains a life-threatening injury the immediate goal of the medical system is to assure the provision of critical care services. In practice, this objective has been met most effectively by the linkage of community-based hospitals with regional, tertiary level facilities. This linkage can be informal, based upon traditional ties between facilities or physicians. However, increasingly these linkages have become more formal, depending upon structured mechanisms for triage and patient transfer. The process of organizing and maintaining such a system of expeditious patient transfer to facilities with critical care expertise is commonly known as the "regionalization" of critical, or tertiary, care services. The regionalization of tertiary services has taken on special importance in caring for children, in that the expertise, equipment, and medications required for the intensive care of pediatric patients may differ substantially from those needed for adults.

Because the regionalization of tertiary medical services has been deemed a desirable public goal and has required the coordination of a number of institutional and public policies, this process has been supported by active public policymaking and resource allocation. This issue, therefore, is a relevant focus for the analysis of patterns of childhood mortality in the Commonwealth.

METHODS

As part of the larger project, data on the site of death were collected for all deaths. In addition, information on whether the child was transferred to the hospital of death from another hospital was also ascertained. Data were collected on the length of time from admission to the source hospital to transfer to the destination hospital, the period from admission at the destination hospital until death, and the timing of endotracheal intubation for respiratory support. In this manner, the period of time the child received care in the source hospital, the time elapsed before requiring intubation, and the time the transfer and intubation occurred in relation to the time of death were analyzed.

In assessing these data, the primary assumption is that regionalized pediatric care is a desirable goal. This assumption mandates that a child requiring intensive, tertiary level care should receive such care in a tertiary hospital as quickly as possible. However, there may be important exceptions to this standard that should be noted. The end-stage management of a recognized, terminal illness may be deemed appropriate for a local, community-based hospital. Being near family and friends, in familiar surroundings, may represent a caring and practical alternative to care in a specialized, tertiary facility. Therefore, a prolonged stay at a community hospital prior to death without transfer to a tertiary facility may be appropriate for specific causes of death, particularly certain forms of cancer.

FINDINGS

Injuries:

Of the total 404 injury-related deaths, 179 (44.3%) occurred out-of-hospital: at the injury scene, home, or on route to a hospital. More succinctly, almost half of all children dying from injuries never reached a hospital, or were dead on arrival. (See Chart H.)

Two hundred twenty-five (55.7%) of all injury-related deaths occurred in-hospital: care was delivered in a hospital facility and death was declared in such a facility. Twenty-four of these cases died in an out-of-state hospital and no transfer data were available. Of the remaining 201 cases of in-hospital injury deaths, 152 (75.6%) were not transferred and died in the hospital to which they were first brought for treatment. Forty-nine (24.4%) were transferred for care.

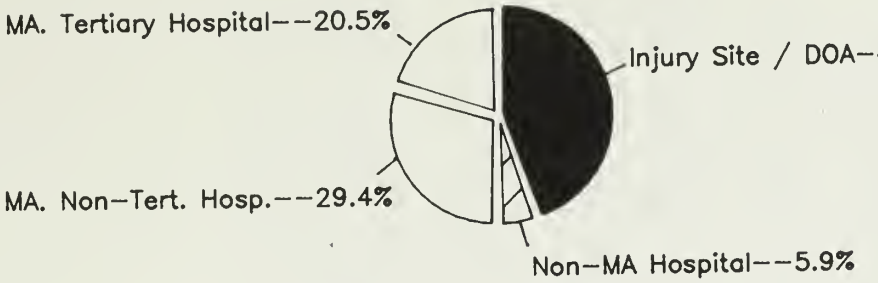
Non-transferred cases were of two types: 1) instances where children were brought to non-tertiary hospitals, primarily local, community hospitals and not transferred; and 2) cases where children were brought directly to a tertiary level hospital where they remained until death. The majority of non-transferred cases were of the first type; 110 (72.4%) of non-transferred injury deaths occurred in non-tertiary, community hospitals. Forty-two (27.6%) of the non-transferred cases were brought directly to tertiary facilities.

Regionalization implies that critically injured children should be transferred to a tertiary setting. The fact that 110 cases were not transferred conflicts directly with this requirement. However, upon further analysis it becomes clear that a large portion of these cases died shortly after reaching the hospital, thereby minimizing the opportunity for transfer. Of the 110 community hospital deaths, 58 (52.7%) died within one hour after reaching the hospital for care. Another 26 (23.6%) died within 12 hours after reaching the hospital; four (3.6%) died from 12 to 24 hours after reaching the hospital. Twenty-two cases (20%) remained in non-tertiary hospitals for longer than 24 hours.

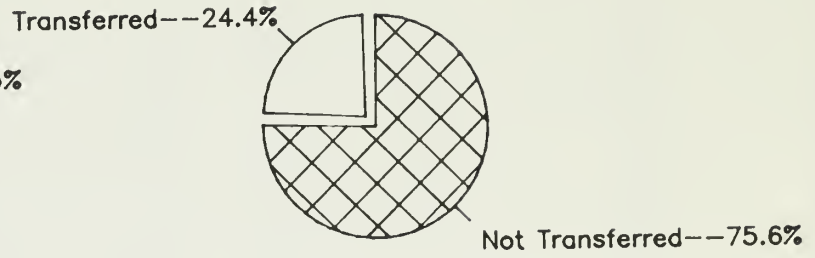
Among the transferred cases, three were receiving long term care for months or years. Of the remaining 46 transferred cases, 41 (89.1%) were moved to a tertiary care facility, and five (10.9%) were moved to another non-tertiary hospital. Two of the latter five cases died in the second hospital within 12 hours of admission.

These data indicate that of the 201 children brought to a hospital for care, the majority (85.6%) were either brought directly to a tertiary facility, were transferred to a tertiary facility, or died within 12 hours after being admitted to a hospital. Of the remaining 29 cases (14.4%) who died in a non-tertiary hospital more than 12 hours post hospital admission, 22 were adolescents between the ages of 16 and 19, and five were younger teens 12-15 years old. Only two such cases occurred with children below the age of 12. This suggests that young children who presented with critical injuries either died within several hours after reaching a hospital or were more likely than older children to be transferred. The pattern for older children appears

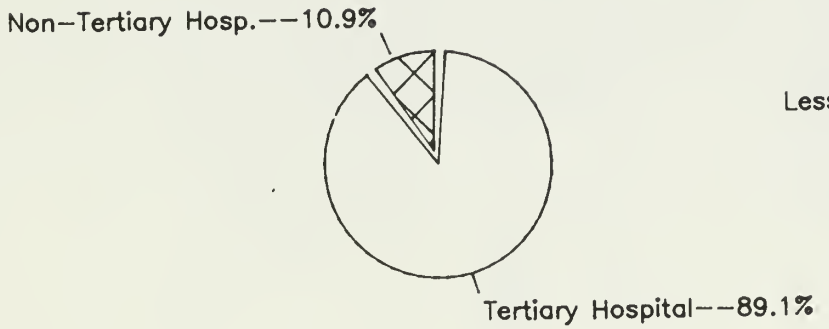
Chart H.
Hospitalization Patterns of Injury Deaths
Mass. Children Ages 0–19, 1985



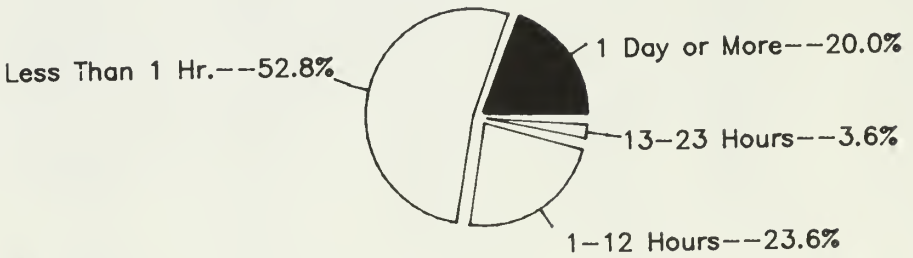
1. Site of Injury Death



2. Transfer Status of MA. Hospital Deaths



3. Destination Hospital of Transfers
(excludes 3 LTC cases)



4. Time from Hospitalization to Death: Non–Transfers

to resemble that which dominates adult trauma care, with non-tertiary hospitals more likely to provide care to the critically injured without ultimate transfer to a tertiary facility.

Medical conditions

During 1985, there were a total of 389 cases of childhood death from medical conditions. Fifty-three cases (13.6%) died out-of-hospital and 336 died within a hospital setting. The largest medical contributors to the out-of-hospital deaths were Sudden Infant Death Syndrome (SIDS) and cancer. Of the 336 in-hospital deaths, 19 cases did not have sufficient information to assess transfer history.

Of the remaining 317 in-hospital deaths, 255 (80.4%) were not transferred from the primary source hospital. However, 126 (49.4%) of these cases were brought directly to a tertiary center, thereby precluding the necessity of transfer. One hundred twenty-nine (50.6%) were cared for in a non-tertiary hospital and not transferred. However, 45 of these cases were due to SIDS, where in most cases death was declared upon the completion of unsuccessful resuscitative measures in a hospital emergency unit. Furthermore, 72% of the non-tertiary cases that were not transferred were deaths that occurred within 12 hours of admission to the hospital. Among the 62 cases that were transferred, 56 (90.3%) were moved to a tertiary level hospital.

As was evident for injuries, the vast majority of children who died from medical conditions were either brought directly to a tertiary care center, were transferred to such a center, or died within hours of presenting to a hospital facility. The reasons for not transferring the 32 children who received care for longer than one day in a non-tertiary hospital remains unclear.

Although the likelihood of transfer was high if the child survived the first few hours of hospitalization, the relatively large number of children not surviving the first day of hospitalization is of concern. Unlike injuries which are catastrophic events usually resulting in immediate transport to a medical facility, medical illnesses are often more indolent, requiring a period of time for clinical expression. Although this issue was examined briefly in the previous section, the potential for earlier recognition of serious illness seems worthy of reemphasis and further study.

Another dissimilarity with injury-related mortality was the relatively high proportion of cases presenting directly to tertiary centers for care. Excluding cases of SIDS, approximately half (49.2%) of all in-hospital deaths were cases where children presented initially for care at tertiary medical centers. This suggests that prior association with tertiary hospitals, particularly for serious chronic conditions, direct referral from physician offices, or a family generated desire for evaluation at these institutions had a significant impact on the pattern of critical care service utilization in the Commonwealth.

SUMMARY

- The medical care system in the Commonwealth depends heavily on regionalized critical care services for children.

- Almost half of all children dying from trauma did not survive long enough to reach a hospital alive for emergency care.

- Of the critically injured children who survived the initial hours after the traumatic event, almost all were transferred to a tertiary level facility.

- Although only a small proportion of children suffering from medical conditions died outside a hospital setting, a significant number died within the first 24 hours after hospital admission.

- Approximately half of all children dying from medical conditions were admitted directly to tertiary facilities. Those admitted to non-tertiary facilities were likely to be transferred if they survived the initial hours of hospitalization.

- Because of the high concentration of mortality in the first few hours after sustaining injury, the primary arena for reducing mortality in children in the Commonwealth would appear to be prevention. In addition, the initial on-scene response, transport, and emergency management of critically injured children also represents a focus for improving childhood survival.

Chapter VII Recommendations

The Commonwealth of Massachusetts has taken a leadership role in ensuring the well-being of the state's children. In initiating a study on preventable child deaths, the Legislature has affirmed its commitment to children and to the concept of prevention as an important public policy tool.

Among the major findings of this report is the disparity in the health status of different socioeconomic groups. This is particularly true for infant mortality rates, and is currently being addressed through ongoing initiatives of the Department of Public Health.

While inroads to preventing infectious diseases (once the major cause of death) and improving the chances of survival for critically ill children have been made through advances in medical care and better access to health services, injury continues to take its toll as the leading cause of death to children. This is an important finding of this report, and confirms the conclusions of the 1985 report of the National Academy of Sciences, Injury In America: "Injury is the principal public health problem in America today." Given the major impact of injuries on children's health, as compared to the scant attention devoted to injury prevention, the major recommendation of this report is the implementation of a Childhood Injury Prevention Initiative through a designated state agency.

Most injuries can be predicted and prevented. Opportunities to understand and prevent injuries and reduce their effects are known. In 1985, 404 Massachusetts children died as the result of injury; 60 percent of these deaths occurred in situations where the use of known preventive measures could have changed the outcome of the event. The Study has been successful in identifying risk factors for death due to unintentional and intentional injury. These risk factors include age, sex, socioeconomic status, and geographical location, and should be taken into consideration in targeting prevention efforts.

Although many agencies and organizations are already involved in injury prevention programming, a statewide strategic plan which would help to coordinate these efforts is needed. A lead state agency should be designated for this purpose. The role of the lead state agency is to serve as a statewide focal point for injury prevention expertise and guidance and providing the resources and leadership for effective local program development and evaluation. In addition, the agency provides leadership on policy, legislative and regulatory matters.

Since 1979, the Department of Public Health (DPH) has pioneered innovative injury prevention activities through the use of public health strategies. The Department's Statewide Comprehensive Injury Prevention Program (SCIPP) has developed model programs for preventing unintentional injuries. Given its history in injury control, and the concept that injuries are a major public health problem, it is recommended that the Department of Public Health be designated as the lead agency.

In this initiative, four areas deserve special attention. In each, a first step would be to determine where prevention strategies can be integrated into existing programs. Second, where there are gaps in programming or populations served, new initiatives need to be considered. An appropriate combination of behavorial, environmental and regulatory/legislative strategies should be implemented. These four areas include:

A. Adolescents. Adolescents are the only group among children who did not experience a decline in death rate over the last 30 years. Three quarters of the deaths among 15 - 19 year olds were due to injuries, the majority occurring among adolescent males. Adolescent deaths affect all social and income groups, and are an issue of concern in all parts of the state. Findings of this Study demonstrate that risk-taking, in its many forms, characterizes many of the circumstances associated with adolescent injuries and deaths.

B. Violence. Child Death Study findings provide persuasive evidence of the serious toll of violence among children and adolescents. Although traditionally perceived solely as a criminal justice issue, more recently, a public health approach to violence prevention has been developed as a result of an increased understanding of the characteristics of violence and its causes. The public health model is multidisciplinary, and uses strategies to affect primary prevention, secondary prevention and more intensive interventions. Such techniques as community organizing and educational interventions can be used to address both the societal values that support violent behaviors as well as the availability and carrying of weapons. Working in collaboration with public safety and criminal justice officials, public health providers must carefully target efforts to high risk populations to be effective in reducing violence.

C. Motor vehicle-related injuries. In the Study, over half of all injury deaths among children and adolescents were motor vehicle-related. Any attempt to substantially reduce the toll of injury deaths among children must address this topic. These deaths were more prevalent among children from middle and high income localities. There are many injury prevention and control strategies available, including: education and incentive programs regarding drinking and driving and safety belt use, strict enforcement of driving laws, expansion of car restraint legislation, new design options such as automatic safety belts and airbags, and licensure age and curfew requirements for young drivers. All of these approaches need to be evaluated and considered for future action.

D. Injury Surveillance. An important component of an injury prevention program is the capacity to monitor trends and patterns in child mortality and morbidity over time, through an injury surveillance system. Such a system should be developed for implementation in FY 1990. This is, in part, a recognition of the underreporting issues in vital statistics records, but, more importantly, responds to the need for ongoing, comprehensive injury-related information to maximize targeting of services and assessment of program effects.

This Study confirmed that human service agencies already serve children who are at high risk; and therefore can serve as access points for prevention efforts. Under the proposed injury prevention initiative, training should be provided to relevant state agency staff for the purpose of maximizing their skills in preventing injuries. Some examples of this type of sharing of information include:

- All case workers who transport children should be familiar with the state's child passenger safety law; should have access to a child restraint device when appropriate; and should understand how to use such a device properly (national estimates indicate that over 60 percent of child restraint devices are improperly used, greatly diminishing their safety potential).

- Staff whose clients are adolescents involved in fights or other acts of violence might benefit from the expertise developed by staff of an urban violence prevention program, in teaching youths alternatives to violence.

- Agencies using home visitors could be trained in a home safety program which utilizes a checklist to identify and remedy hazards to children ages birth to 6.

To begin to make the kinds of improvements in the arena of childhood injury prevention that have been made in infectious disease control, efforts to prevent injuries must be designated as a priority. This initiative should be supported by a combination of state, federal, foundation and corporate funds.

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1984 Membership of the Special Commission on Violence Against Children:

Robert Ambler, State Representative

Chester Atkins, Senate Chairman, Special Commission

Ellen Canavan, State Representative

Michael Creedon, House Chairman, Special Commission

Joseph DeNucci, State Representative

Patricia McGovern, State Senator

Susan Tucker, State Representative

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APPENDIX B POPULATION ESTIMATES

The Child Death Study prepared population estimates in order to calculate child death rates for the five-year period of 1980 through 1984. The following method was used to estimate the population of Massachusetts residents in the 0-19 age group.

The 1980 census figures for each individual age and sex/race category were used as a basis for calculations. These numbers were taken from the 1980 Census of Population, General Population Characteristics: Massachusetts, issued by the U.S. Department of Commerce. The population estimates for 1981 through 1984 were computed by advancing every age cohort to the next age classification in each succeeding year and subtracting deaths so that, for example, the number of one year olds in 1980 minus the number of one year olds who died in that year comprised the initial assignment for two year olds in 1981. The information on the number of deaths at each age for all the years included in the Study was derived from Massachusetts death certificates.

Birth certificates provided the information needed to calculate the numbers of children in the youngest age groups for 1981 to 1984. For each year, the total number of births minus the infant deaths constituted the number making up the under one age group, and those values were moved up through the age intervals correspondingly. Both birth and death certificate information is based on official reports of the Massachusetts Registry of Vital Records and Statistics.

According to State Population Estimates, by Age and Components of Change: 1980 to 1984, published by the U.S. Bureau of the Census, the net change in the Massachusetts population from 1980 to 1984 was a loss of one half of a percent overall, therefore, the estimated values were reduced to account for out-migration. The net loss was distributed across the four years being estimated in this project to produce the final set of estimates.

Individual age values were combined into five age groups for each year from 1980 through 1984. Death rates by age, sex, race and cause of death were calculated for each year and for the total five-year period 1980 through 1984.

Table 27 PERCENT OF CHILDREN KNOWN TO DPW* BY AGE AND CAUSE OF DEATH

Age	Medical Conditions	Injury	All Causes	(N)
Under 1**	40%	27%	40%	(294)
1-4	43%	48%	45%	(111)
5-9	39%	31%	35%	(49)
10-14	52%	20%	30%	(86)
15-19	41%	15%	21%	(338)
All Ages	41%	21%	32%	
(N)	(475)	(401)		(878)

* Known to DPW means that the child's name appeared on DPW records for 1985. Of 1332 children known to the Child Death Study, 358 were identified as receiving some form of DPW assistance. Of the 878 children aged seven days through 19 years, 281 received DPW assistance. Fifty of these children were identified as Medicaid recipients through hospital record review only.

** Children seven days - eleven months old. (Of 453 children less than seven days old, 77 or 17% were identified as known.)

Table 28 NUMBER AND PERCENT OF CHILDREN* KNOWN TO DPW BY CAUSE OF DEATH

Cause of Death	Number	Percent	(N)
Fire	9	50%	(18)
Medical	197	41	(475)
Homicide	16	39	(41)
Suicide	10	16	(61)
MVA	31	15	(210)
Other Injuries	17	24	(71)
Unknown Causes	1	--	(2)
All Causes	281	32%	(878)

* Children ages seven days through 19 years.

Table 29 INJURY PROBLEMS AND LOSS REDUCTION STRATEGIES

Injury Problem	Method of Loss Reduction
Motor vehicle occupants	Infant seat restraints for ages $\leq$ 4 yr Air bags for 5- to 14-year old front seat occupants
Motorcycles	Helmets
Pedal cycles	Helmets
Poisoning	Expansion/enforcement of Poison Prevention Packaging Act
Drownings	Barriers around pools
Fire and flames	Self-extinguishing cigarettes and smoke detectors
Firearms (nonintentional, homicide, and suicide)	Elimination of handguns
Choking or suffocation	Heimlich maneuver and Consumer Product Safety Commission regulations
Falls	Window bars

Source: Rivara, F.P. Traumatic Deaths of Children in the United States: Currently available prevention strategies. Pediatrics 1985; 75:456-462.

APPENDIX D

Deaths of Children 0-19 by City and Town

Town	5 Year Average Rate* 1980-84**	Number of Child Deaths 1980-1984**	Number of Child Deaths 1985***	1985 Town Child Population****
Abington	94.24	22	2	4335
Acton	69.94	21	5	5191
Acushnet	-.-	8	5	2480
Adams	-.-	5	-	2279
Agawam	74.65	29	2	6941
Alford	-.-	-	-	76
Amesbury	79.91	18	7	4298
Amherst	29.99	16	3	7709
Andover	26.66	12	2	8271
Arlington	71.97	41	7	9236
Ashburnham	-.-	5	-	1375
Ashby	-.-	5	-	774
Ashfield	-.-	2	-	378
Ashland	-.-	8	-	2819
Athol	-.-	13	-	2991
Attleboro	67.05	37	11	10051
Auburn	54.67	12	4	3883
Avon	-.-	8	2	1406
Ayer	-.-	19	10	2001
Barnstable	86.34	36	4	8724
Barre	-.-	5	2	1259
Becket	-.-	4	2	435
Bedford	116.39	24	3	3497
Belchertown	-.-	9	2	2124
Bellingham	107.01	30	6	4847
Belmont	35.55	11	6	5156
Berkley	-.-	1	-	1078
Berlin	-.-	3	-	720
Bernardston	-.-	1	1	501
Beverly	72.96	40	4	9837
Billerica	83.15	59	7	12554
Blackstone	-.-	8	2	2160
Blandford	-.-	-	1	338
Bolton	-.-	-	-	906
Boston	110.69	837	189	136259

* Rate per 100,000 children age 0-19. Rate given only for towns with a child population of at least 4000. (Population denominators by city and town were based on the 1980 census for the entire 5-year period.)

** Numbers from Vital Statistics data.

*** Numbers from Child Death Study data.

****Child population denominators based on census projections for 1985.

APPENDIX D (continued)

Town	5 Year Average Rate* 1980-84**	Number of Child Deaths 1980-1984**	Number of Child Deaths 1985***	1985 Town Child Population****
Bourne	79.89	18	1	4546
Boxborough	-.-	5	1	828
Boxford	-.-	4	-	1907
Boylston	-.-	6	-	908
Braintree	61.97	34	6	9237
Brewster	-.-	5	-	1563
Bridgewater	79.32	22	1	5412
Brimfield	-.-	4	1	683
Brockton	96.22	154	42	30312
Brookfield	-.-	2	1	716
Brookline	86.16	44	3	8773
Buckland	-.-	1	1	549
Burlington	47.16	20	4	7162
Cambridge	73.25	77	20	18653
Canton	78.50	24	5	5311
Carlisle	-.-	4	1	1087
Carver	-.-	8	3	3267
Charlemont	-.-	2	-	349
Charlton	-.-	7	1	2466
Chatham	-.-	3	-	1171
Chelmsford	46.56	26	9	9560
Chelsea	82.99	31	8	6713
Cheshire	-.-	3	-	924
Chester	-.-	-	-	316
Chesterfield	-.-	-	-	305
Chicopee	85.16	67	10	14292
Chilmark	-.-	-	-	112
Clarksbury	-.-	-	1	490
Clinton	-.-	19	9	3559
Cohasset	-.-	9	3	1941
Colrain	-.-	2	-	484
Concord	59.03	15	3	1941
Conway	-.-	-	-	321
Cummington	-.-	3	-	168
Dalton	-.-	18	1	1858
Danvers	67.62	24	5	6337
Dartmouth	37.82	14	6	7048
Dedham	64.14	24	3	6238
Deerfield	-.-	4	1	1118
Dennis	-.-	14	4	2816
Dighton	-.-	11	1	1629
Douglas	-.-	3	1	1381
Dover	-.-	2	1	1368
Dracut	91.68	33	7	6716
Dudley	-.-	12	2	2559
Dunstable	-.-	1	-	636

APPENDIX D (continued)

Town	5 Year Average Rate* 1980-84**	Number of Child Deaths 1980-1984**	Number of Child Deaths 1985***	1985 Town Child Population****
Duxbury	54.27	12	5	4486
E Bridgewater	-.-	10	1	3418
E Brookfield	-.-	1	2	598
E Longmeadow	-.-	9	2	3320
Eastham	-.-	4	-	899
Easthampton	68.80	16	2	4155
Easton	64.30	19	5	5767
Edgartown	-.-	2	-	614
Egremont	-.-	2	1	322
Erving	-.-	1	-	395
Essex	-.-	1	2	777
Everett	59.02	29	7	8399
Fairhaven	72.51	16	-	4019
Fall River	75.36	105	16	25497
Falmouth	84.24	29	7	6768
Fitchburg	94.66	58	13	11318
Florida	-.-	2	-	222
Foxborough	46.05	11	4	4197
Framingham	68.30	63	13	16059
Franklin	72.47	25	3	6356
Freetown	-.-	10	1	2559
Gardner	102.73	26	5	4698
Gay Head	-.-	-	-	48
Georgetown	-.-	3	1	1876
Gill	-.-	1	4	354
Gloucester	68.33	27	9	7226
Goshen	-.-	-	-	210
Gosnold	-.-	-	-	9
Grafton	-.-	13	2	3423
Granby	-.-	12	2	1642
Granville	-.-	1	-	389
Gt. Barrington	-.-	25	2	1825
Greenfield	118.73	31	5	4713
Groton	-.-	13	1	2111
Groveland	-.-	5	1	1634
Hadley	-.-	6	-	873
Halifax	-.-	9	3	1909
Hamilton	-.-	2	1	2032
Hampden	-.-	3	2	1431
Hancock	-.-	-	-	174
Hanover	74.96	17	2	4177
Hanson	-.-	14	2	3210
Hardwick	-.-	3	-	659
Harvard	30.61	7	1	4489
Harwich	-.-	7	3	2114
Hatfield	-.-	1	-	715

APPENDIX D (continued)

Town	5 Year Average Rate* 1980-84**	Number of Child Deaths 1980-1984**	Number of Child Deaths 1985***	1985 Town Child Population****
Haverhill	125.39	90	9	13323
Hawley	-.-	-	-	96
Heath	-.-	1	-	159
Hingham	48.74	17	5	6250
Hinsdale	-.-	5	-	491
Holbrook	-.-	10	5	3349
Holden	33.95	7	3	3783
Holland	-.-	1	-	496
Holliston	34.39	8	2	4106
Holyoke	132.55	92	14	12591
Hopedale	-.-	1	2	1000
Hopkinton	-.-	13	-	2305
Hubbardston	-.-	5	1	646
Hudson	84.57	24	3	5215
Hull	-.-	18	-	3013
Huntington	-.-	6	-	589
Ipswich	-.-	9	2	2982
Kingston	-.-	10	1	2366
Lakeville	-.-	11	3	1987
Lancaster	-.-	5	-	2108
Lanesborough	-.-	1	1	870
Lawrence	113.14	115	27	19693
Lee	-.-	6	1	1672
Leicester	-.-	6	7	3087
Lenox	-.-	6	1	1606
Leominster	98.28	53	8	9936
Leverett	-.-	1	2	392
Lexington	50.57	22	4	7361
Leyden	-.-	-	-	163
Lincoln	-.-	7	-	2155
Littleton	-.-	6	1	2065
Longmeadow	35.39	10	1	4917
Lowell	101.83	152	38	26955
Ludlow	85.68	24	3	4991
Lunenburg	-.-	6	1	2633
Lynn	95.35	109	31	21182
Lynnfield	-.-	7	-	3204
Malden	72.12	51	5	12348
Manchester	-.-	3	-	1485
Mansfield	91.00	22	6	4629
Marblehead	39.17	10	2	4423
Marion	-.-	5	1	1182
Marlborough	69.66	33	8	8457
Marshfield	61.45	23	5	7222
Mashpee	-.-	4	2	1187
Mattapoisett	-.-	6	-	1673

APPENDIX D (continued)

Town	5 Year Average Rate* 1980-84**	Number of Child Deaths 1980-1984**	Number of Child Deaths 1985***	1985 Town Child Population****
Maynard	-.-	15	4	2534
Medfield	-.-	10	3	3168
Medford	74.54	60	7	13796
Medway	-.-	14	6	2845
Melrose	50.56	22	2	7251
Mendon	-.-	6	-	981
Merrimac	-.-	8	1	1488
Methuen	78.14	43	12	10443
Middleborough	86.81	25	3	5583
Middlefield	-.-	1	-	112
Middleton	-.-	5	-	1240
Milford	85.52	32	4	7042
Millbury	-.-	11	1	3352
Millis	-.-	17	3	2071
Millville	-.-	4	-	638
Milton	53.06	19	4	6196
Monroe	-.-	-	-	52
Monson	-.-	11	2	2030
Montague	-.-	7	-	2053
Monterey	-.-	1	-	206
Montgomery	-.-	1	-	216
Mt. Washington	-.-	-	-	15
Nahant	-.-	1	-	856
Nantucket	-.-	8	2	1168
Natick	50.98	22	6	7613
Needham	48.58	20	3	6958
New Ashford	-.-	1	-	28
New Bedford	93.28	136	35	27006
New Braintree	-.-	2	-	221
New Marlborough	-.-	8	-	303
New Salem	-.-	-	-	229
Newbury	-.-	8	1	1458
Newburyport	90.36	21	2	4329
Newton	50.16	56	6	18981
Norfolk	-.-	5	2	2098
North Adams	80.82	22	3	4539
North Andover	47.57	15	2	6088
No. Attleboro	72.84	26	7	6752
No. Brookfield	-.-	6	1	1328
North Reading	-.-	11	2	3419
Northampton	75.22	29	10	6271
Northborough	-.-	15	3	3534
Northbridge	54.97	11	3	3668
Northfield	-.-	4	1	620
Norton	68.89	16	4	4427
Norwell	-.-	12	-	3046

APPENDIX D (continued)

Town	5 Year Average Rate* 1980-84**	Number of Child Deaths 1980-1984**	Number of Child Deaths 1985***	1985 Town Child Population****
Norwood	61.74	25	4	6845
Oak Bluffs	-.-	4	-	558
Oakham	-.-	1	-	324
Orange	-.-	14	3	2234
Orleans	-.-	4	-	993
Otis	-.-	3	-	259
Oxford	47.42	10	2	3944
Palmer	-.-	16	1	2999
Paxton	-.-	11	-	1093
Peabody	66.55	46	11	12461
Pelham	-.-	3	-	329
Pembroke	71.35	19	1	5039
Pepperell	-.-	11	2	2834
Peru	-.-	-	-	241
Petersham	-.-	2	2	280
Phillipston	-.-	-	-	354
Pittsfield	67.09	53	14	13490
Plainfield	-.-	1	-	138
Plainville	-.-	7	2	1645
Plymouth	47.66	29	14	12065
Plympton	-.-	-	-	729
Princeton	-.-	2	1	829
Provincetown	-.-	4	-	611
Quincy	81.85	86	11	18007
Randolph	67.81	28	8	7289
Raynham	-.-	7	-	3074
Reading	57.76	21	2	6210
Rehoboth	-.-	16	2	2529
Revere	67.94	36	12	8392
Richmond	-.-	2	-	440
Rochester	-.-	3	-	1208
Rockland	88.42	25	4	5206
Rockport	-.-	6	1	1291
Rowe	-.-	1	-	91
Rowley	-.-	6	1	1175
Royalston	-.-	-	-	323
Russell	-.-	1	-	476
Rutland	-.-	4	1	1367
Salem	75.83	38	9	9244
Salisbury	-.-	13	2	1970
Sandisfield	-.-	-	-	157
Sandwich	-.-	6	2	3081
Saugus	64.50	24	7	6815
Savoy	-.-	2	-	236
Scituate	68.70	20	2	5355
Seekonk	43.86	9	-	3786

APPENDIX D (continued)

Town	5 Year Average Rate* 1980-84**	Number of Child Deaths 1980-1984**	Number of Child Deaths 1985***	1985 Town Child Population****
Sharon	61.76	14	3	4136
Sheffield	-.-	4	1	703
Shelburne	-.-	4	-	556
Sherborn	-.-	3	1	1358
Shirley	-.-	7	2	1670
Shrewsbury	67.02	22	2	5935
Shutesbury	-.-	2	1	295
Somerset	51.69	15	2	5137
Somerville	65.43	65	10	16936
South Hadley	44.27	11	-	4054
Southampton	-.-	5	-	1334
Southborough	-.-	2	1	2039
Southbridge	73.25	19	1	4787
Southwick	-.-	17	4	2422
Spencer	-.-	20	1	3526
Springfield	113.27	274	55	45035
Sterling	-.-	7	-	1896
Stockbridge	-.-	-	-	491
Stoneham	55.03	17	1	5570
Stoughton	86.18	37	8	7688
Stow	-.-	5	2	1668
Sturbridge	-.-	6	2	2037
Sudbury	38.18	10	3	4469
Sunderland	-.-	-	-	457
Sutton	-.-	9	3	2067
Swampscott	-.-	7	1	3123
Swansea	38.55	10	1	4743
Taunton	88.44	61	10	12821
Templeton	-.-	10	1	1755
Tewksbury	48.48	22	3	7807
Tisbury	-.-	5	1	839
Tolland	-.-	-	-	59
Topsfield	-.-	5	2	1794
Townsend	-.-	14	-	2621
Truro	-.-	3	-	356
Tyngsborough	-.-	7	3	2128
Tyringham	-.-	-	-	73
Upton	-.-	6	2	1203
Uxbridge	-.-	12	-	2506
Wakefield	91.51	32	6	6068
Wales	-.-	1	1	431
Walpole	36.07	11	4	5377
Waltham	61.25	47	9	13181
Ware	-.-	12	-	2367
Wareham	80.59	24	3	5804
Warren	-.-	1	1	1129

APPENDIX D (continued)

Town	5 Year Average Rate* 1980-84**	Number of Child Deaths 1980-1984**	Number of Child Deaths 1985***	1985 Town Child Population****
Warwick	-.-	-	-	142
Washington	-.-	1	-	167
Watertown	55.39	21	5	6327
Wayland	-.-	12	1	3300
Webster	80.44	17	4	3943
Wellesley	60.21	25	2	7089
Wellfleet	-.-	1	-	505
Wendell	-.-	2	-	255
Wenham	-.-	2	1	1085
W. Boylston	-.-	5	1	1541
W. Bridgewater	-.-	4	-	1992
W. Brookfield	-.-	2	-	859
W. Newbury	-.-	5	1	1008
W. Springfield	88.88	33	2	6500
W. Stockbridge	-.-	-	-	311
W. Tisbury	-.-	-	-	319
Westborough	58.94	12	4	3522
Westfield	92.22	54	9	10496
Westford	50.57	13	3	4786
Westhampton	-.-	1	9	386
Westminster	-.-	5	-	1592
Weston	-.-	5	1	2994
Westport	39.69	9	5	4160
Westwood	47.37	10	1	3557
Weymouth	55.90	47	10	14274
Whately	-.-	1	-	360
Whitman	53.22	13	3	4602
Wilbraham	35.00	7	1	3527
Williamsburg	-.-	1	-	611
Williamstown	-.-	7	2	2194
Wilmington	73.68	24	8	5628
Winchendon	-.-	14	-	2322
Winchester	72.39	22	2	5051
Windsor	-.-	1	-	164
Winthrop	76.60	18	2	3523
Woburn	75.42	41	8	9581
Worcester	94.77	221	40	42657
Worthington	-.-	-	1	279
Wrentham	-.-	9	-	2126
Yarmouth	42.58	9	1	4109